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ARTICLE

The advent of serotherapy in Britain tracked by *The Extra Pharmacopoeia*, 1895-1920

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Abstract

The introduction of antitoxins and the growth of serotherapy in Britain can be tracked by analysing successive editions of *The Extra Pharmacopoeia* of Martindale and Westcott. This study shows how the nature, dosing, use, benefits and side-effects of the principal products evolved between 1895 and 1920. No new serum products appeared after 1906, when novel therapeutic vaccines started to become popular, although the two types of preparation co-existed and were sometimes used in combination. Antitoxins and serums for both therapy and prophylaxis received a further boost because of the medical needs of the First World War.

Introduction

In the late nineteenth century, developments in microbiology and bacteriology led by Louis Pasteur (1822-1895) in France and Robert Koch (1843-1910) in Germany brought a new understanding of the agents causing infectious diseases and new ways to tackle them. Animals could be protected from a virulent pathogen by inoculating them with an attenuated version, though not without risk of causing infection.

On 6 December 1890 *The Lancet* and the *British Medical Journal* reported work published two days earlier in the *German Medical Weekly*: at Koch's renowned Institute of Hygiene in Berlin, Emil Behring (1854-1917) and Shibasaburo Kitasato (1852-1931) had succeeded in curing animals infected with diphtheria or tetanus bacilli, and in rendering animals immune to these diseases.[1, 2]

In each case, the key to this immunity was a specific property of blood serum that made harmless the lethal toxin produced by each bacillus. A detailed summary published one week later made clear that this immunity could be readily transmitted from one animal to another by transferring serum. Importantly, the 'antitoxins' made by inoculating animals with either diphtheria or tetanus toxin were potentially useful for both the cure and prevention of their respective diseases in humans.[3]

This paper examines the introduction of antitoxins and the subsequent expansion of serotherapy in Britain as reflected in *The Extra Pharmacopoeia* of Martindale and Westcott.

The Extra Pharmacopoeia

Successive editions of pharmacopoeias reflect scientific and medical advances, the arrival of new remedies, changes in medical practice, improved analytical techniques and introduction of quality standards. *The British Pharmacopoeia* was first published in 1864, but subsequent editions and occasional addenda were published infrequently, making it unsuitable to track fast-changing developments, especially around the turn of the century.[4]

Another resource is the *British Pharmaceutical Codex*, published by the Pharmaceutical Society of Great Britain, which included preparations that were official in the pharmacopoeias of France, Germany and the United States, although the first edition came out only in 1907. An alternative is one of the compendiums that included non-official preparations – designed to supplement the official pharmacopoeia – and were regularly updated.[5]

Most useful for tracking the timetable of serotherapy is *The Extra Pharmacopoeia of Unofficial Drugs and Chemical and Pharmaceutical Preparations*, originally issued in 1883.[6] Its founder was William Martindale (1840-1902), who owned the London pharmacy business trading as W. Martindale of New Cavendish Street, and who was president of the Pharmaceutical Society of Great Britain in 1899-1900. He and subsequently his son, Dr William Harrison Martindale (1874-1933), worked together with Dr William Wynn Westcott (1848-1925), a London coroner, to produce new editions of what became *The Extra Pharmacopoeia of Martindale and Westcott* at intervals of three years or less until 1915, and every four or five years thereafter.[7, 8]

The Extra Pharmacopoeia contains references to contemporary medical and chemical papers in journals and periodicals, which mainly concern therapeutic use, provided for the benefit of 'the prescribing physician and the general practitioner'. The authors quote from the latest versions of official pharmacopoeias from the United States and Europe, the pharmacopoeias of the London hospitals, and specialist monographs. Last, but not least, they draw on the authority of independent institutions such as the British Institute of Preventive Medicine (BIPM).[9]

Each of the ten editions of *The Extra Pharmacopoeia* from 1895 to 1920 carried a special chapter on antitoxins and serums, which allows the introduction of new serum products into Britain and their further evolution to be tracked over time.[10-19] The advantage of using this publication is the frequency and regularity with which the editions were updated, the consistency of authorship and approach, and the wide range of local and international sources drawn upon. This series thus re-

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cords the variety of new antitoxins and serums, changes in their preparation and use, important scientific developments, and the evolution of terminology.

Reliance on a single publication has limitations since its content inevitably reflects the choice of the medical literature consulted and the judgement of the authors in interpreting it. However, *The Extra Pharmacopoeia* is informed by knowledge of both medical research and the medical marketplace, and it captures the 'state of the art' free from the influence of hindsight. As a respected publication, it offers a unique perspective on how knowledgeable practitioners in Britain understood serotherapy in its formative years.

Antitoxins, serums and lymphs

Between 1895 and 1920 *The Extra Pharmacopoeia* listed serum preparations that addressed 24 different categories of disease or disorder (Table 1). The table shows the categories of serum products listed by their date of first appearance in the special chapter devoted to antitoxins and sera. Categories shown in bold remain listed in the nineteenth edition of 1920. The other categories are displayed according to the date of the edition in which they last appeared, shown along the horizontal axis at the bottom. Categories shown in italics are variants of anti-streptococcic serum.

The first mention of antitoxins and serums occurs in the preface to the eighth edition of 1895 which, for the first time, includes special chapters on 'preparations from the animal kingdom, which till recently had been almost entirely neglected as curative agents'.[20, 21] Such preparations are clearly different from traditional remedies obtained from plants, and from chemical remedies of more definite composition, and have to be injected by hypodermic syringe. In the chapter titled 'Antitoxins. Serums and Lymphs,' antitoxins are firmly placed in the context of 'the discovery of the medicinal powers of the serum of animals which have been rendered immune to certain diseases.' [22]

The longest section, on 'Diphtheria Serum and Antitoxin', describes how horses are immunised and bled to prepare antitoxic serum 'for use as a remedy, and as a prophylactic'. Its properties are summarised as follows:

> This serum combats the disease in the human subject, and experience has shown that it can be safely injected into healthy children without causing any ill effects beyond an occasional appearance of urticaria.[23]

Laboratory studies are mentioned briefly and there are extensive references to reports of clinical use, including the first trials conducted in Germany, the earliest English cases, and large-scale French trials. Several producers are mentioned. The BIPM in London and the Pasteur Institute in Paris supply the serum 'in its natural state but rendered aseptic'.[23] In the former case, sterilized camphor is added. Aronson of Berlin makes a pat-

Table 1. *Timetable of serotherapy development in Britain, 1895-1920*

Year of first entry	**Categories of serum products**				
1895	**Diphtheria Serum and Antitoxin** **Tetanus Antitoxin**				Rabies Antitoxin
1898	**Septicaemia (Anti-Streptococcic Serum)** **Anthrax**	Antitubercular Serum Cholera Virus The Plague		Typhoid Fever Serpent Venom Sarcoma and Malignant Tumours	Leprosy Syphilis
1901	**Pneumonia (Anti-Pneumococcic Serum)**				Alcoholism
1904	**Dysentery** **Anti-Colon Bacillus Serum**			*Scarlatina* Trypanosomiasis	
1906	**Cerebro-Spinal Fever**		*Rheumatism*	*Anti-Gonococcus Serum* *Scarlet Fever Serum*	
1912		Hay Fever Serum			
	1920	1915	1912	1910	1901
	Year of last entry				

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ented preparation that has been purified and concentrated, and is preserved by adding *Trikresol* (tricresol). Doses range from 1cc for prophylaxis in a child to 10cc for treatment. Behring and Ehrlich supply 10cc-doses in four strengths. The reader is cautioned to exercise care in comparing preparations made by different authorities, and at different times, which 'vary largely in strength'.[23]

A shorter section on 'Tetanus Antitoxin' credits Tizzoni and Cattani in Italy with the idea of curing tetanus by an 'animal extract', briefly describes how animals are rendered immune by repeated inoculations of 'tetanic poison' and gives references to clinical case reports. The assessment reads:

> The general result has been to show that in acute cases, supervening at once on an injury, the antitoxin has been useless; but that in cases where the onset is long delayed the antitoxin does exercise a controlling influence and such cases generally recover under its use.[24]

It is noted that no supply of English manufacture is available.

Another section refers to 'Rabies Antitoxin'. Dogs were inoculated with the 'rabies poison' from spinal cord to set up immunity. An 'anti-rabic virus' was obtained and then injected into patients with hydrophobia. Prophylactic use in people bitten by mad dogs is also mentioned. The judgment is equivocal:

> Many successful cases were reported, but grave doubts have been thrown upon the treatment, and it has even been asserted that hydrophobia has been caused by this method.[25]

The description of Pasteur's vaccine preparation as an antitoxin is misleading but understandable since the terms toxin, poison and virus are not distinguished and often used interchangeably. Use of the term vaccine is restricted to 'Vaccine, Calf-Lymph,' which is a preparation of cow-pox (*Vaccinia virus*) used for inoculation against smallpox, although this is not explained. A further section, under the heading 'Cholera Virus,' refers to Haffkine's 'attenuated choleraic poison' for protective inoculation.[26]

Other sections cover the use of bacterial products: first, Coley's use of toxins from *Streptococcus erysipelatosus* and *Bacillus prodigiosus* to treat sarcoma and carcinoma; and second, Koch's 'Tuberculin' to treat tuberculosis and an extract called 'Tuberculocidin Solution,' the latter two included for the first time in the previous edition of 1892.[26]

Table 2. *Diphtheria serum and antitoxin: key developments, 1895-1912*

Year	Category	Comments
1895	Producers	BIPM (London), Pasteur Institute (Paris), Aronson (Berlin), Behring & Ehrlich.
	Doses	Various liquid and dried dosage forms in different strengths.
1898	Products	'Behring's Extra Potent Serum', 'Merck Serum' and 'French Serum of Roux.'
	Potency	Measured in standard 'units of immunity.'
1901	Products	'Serum Antidiphthericum' (*Pharmacopoea Germanica*). 'Aronson's Diphtheria Antitoxin' (E. Schering) under German government control.
1904	Potency	Determined as neutralising power in Ehrlich-Behring units.
	Doses	For therapy: 1,500-2,000 units, frequently much more injected. For prophylaxis: 500-1,000 units; immunity claimed to last three weeks.
	Use	Inject antitoxin 'at once' without waiting for bacteriological diagnosis. Use sterile syringe and needle, cleanse skin with ether soap, inject in flank/scapulae. Safer to give too many units than too few; 'brilliant results' obtained by injecting iv.
	Side effects	Lower volumes of higher strength serum cause less rash, pain and swelling.
1906	Products	'Serum Antidiphthericum' (*U.S. Pharmacopoeia*), controlled by US government. 'Solid Anti-Diphtheria Serum' (*Farmacopea Espanola*) by evaporating *in vacuo*.
	Use	Avoid wide-bore needle; warm serum before injection; take care not to inject air. Advantage of iv injection questioned; efficacy by oral and rectal routes disputed.
1908	Products	'Serum Antidiphthericum, Liquidum & Siccum' (*Pharmacopoeia Japonica*).
1910	Doses	Lister Institute: initial dose increases with lapse of time since onset of disease. By second day, give 4,000-8,000 units; by third day, 8,000-12,000 units.

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Year	Category	Comments
1912	Doses	Up to 20,000 units for a severe case now used at Eastern Fever Hospital.
	Side effects	Symptoms of 'Diphtheria Serum Sickness' are fever, rash, usually urticarial or variety of erythema multiforme.
		More unpleasant effects include pain in joints, tendons and fasciae with fever.
		Serum disease a familiar example of increased susceptibility or anaphylaxis.
	Use	Antitoxin no longer approved as prophylactic; indiscriminate use unjustifiable.

Antitoxins

The most important serum product in the period before the First World War is diphtheria antitoxin, which had been used successfully to treat acute cases of diphtheria in children. Table 2 shows the key developments in this category regarding changes in the product, its dosing, medical use, clinical benefits and side effects. Concerns about the variation in strength of serums made by different producers are reflected in the definition of 'units of immunity' by 1898.[27] By 1901 'Serum Antidiphthericum' is an official remedy listed in the *Pharmacopoea Germanica* (fourth edition, 1900), followed by the *Pharmacopoeia of the United States* (official from 1905) in 1906, and subsequently others. By 1904 the strength of recommended doses is being quoted in terms of standardised antitoxin units.

In 1904 and 1906, the reader is given practical advice to use diphtheria antitoxin early and in sufficient quantities, and tutored in how to prepare and inject it safely. Although typically administered by subcutaneous injection, intravenous injections are also employed, though not without the criticism that they are more complicated to administer. Others attempt oral and rectal delivery, although claims of efficacy are disputed.

Advantage is claimed for the use of higher potency serums owing to reduced side-effects. By 1910, the doses employed have increased significantly, especially in the case of delayed treatment. Diphtheria antitoxin for prophylaxis is first flagged in 1904, but by 1912 this use is frowned upon because of the side effects. For the first time there is a detailed description of the disorder known as 'serum sickness', caused by hypersensitivity to horse protein with the attendant risk of anaphylaxis, and a caution regarding the indiscriminate use of antitoxin.

Table 3. *Tetanus antitoxin: key developments, 1895-1912*

Year	Category	Comments
1895	Producers	Cattani & Tizzoni (Italy) and Pasteur Institute (Paris).
1898	Producers	Tizzoni & Cattani, Roux, Behring, and BIPM (London).
	Doses	10-20cc every 6 or 12 hours, according to the severity of symptoms.
1901	Use	Intracerebral and subdural injection advocated by Roux & Borrel (Paris).
		Also used in addition to ordinary subcutaneous injection.
1904	Producers	Lister Institute and Pasteur Institute supply liquid and dried antitoxin.
	Potency	Should possess a potency of at least 1,000,000 Roux Units.
	Doses	20-30cc subcutaneous at outset, followed by 10cc every 8 hours.
		If time elapsed, 10cc intravenous, then 20cc subcutaneous every 8 hours.
	Use	Administer antitoxin without delay where slightest suspicion of tetanus.
		For prophylaxis: excise wound, scrape out, and swab with iodine solution.
		Repeat injection as immunity lasts 3 weeks vs 1-month incubation period for tetanus.
	Products	'Dry pulverised Anti-tetanus Serum' recommended for dusting infected wounds.
		Also used to treat infection of umbilical cord in new-borns.
1906	Products	'Tetanus Antitoxin' *(Pharmacopoea Belgica)* with potency left to the manufacturer.
	Doses	Lister Institute: at least 100cc subcutaneous, repeated next 2 days, final injection after 10 days.
		For prophylaxis: 20cc for lacerated wounds, especially when soiled with earth.
1908	Products	'Serum Antitetanicum, Liquidum & Siccum' *(P. Jap.)*.
1910	Doses	Lister Institute: 30cc urgently intravenous, 100cc subcutaneous (25cc into 4 separate parts of the body); repeat subcutaneous dose on 2 following days; repeat intravenous injection if no improvement.
1912	Doses	Even larger doses advised by some makers.

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In the case of tetanus antitoxin (Table 3), by 1898 there are several producers on the continent as well as the BIPM in London. From this date, doses are typically quoted in terms of serum volume, although standard units are referred to when measuring potency from 1904. Although tetanus antitoxin does not become an official remedy until the *Pharmacopoea Belgica* (third edition, 1906), like diphtheria antitoxin, it is available in both liquid and dried forms.

Given the difficulty of treating acute cases, intracerebral and subdural injections are being advocated in addition to subcutaneous injection in 1901. In 1904 the advice is to use antitoxin without delay at the slightest suspicion of tetanus, and to repeat subcutaneous doses regularly. When there is a delay after onset of symptoms, an initial intravenous dose is advised, followed by increased repeat doses. The intensity of recommended dosing increases in subsequent years. The use of tetanus antitoxin for the prophylactic treatment of patients with wounds is first spelled out in 1904, as is the use of a dried serum to 'dust' soiled and potentially infected wounds or the umbilical cord of at-risk newborns. Side-effects are not discussed, even as late as 1912.

As far as rabies antitoxin is concerned, the 1898 edition mentions a specific serum antitoxin for rabies raised in animals in the conventional way by Tizzoni. After the next edition of 1901, however, there is no further mention of antitoxins or serums for the treatment of rabies, although the original erroneous heading is retained in relation to Pasteur's vaccine.

Serotherapy

In the 1898 edition the special chapter is renamed 'Antitoxins. Serotherapy'.[11] References to lectures, discussions and editorials are followed by a 'Note of Caution' in which the authors excuse themselves from making recommendations, advising physicians to heed the maker's advice, and advises readers that

> The constitution, mode of preparation and standards of strength of these serums, lymphs, and antitoxins of animal origin are still very indefinite. The preparations obtainable at the present time are rarely those which are referred to by physicians, even as to cases of last year. The modes of manufacture are still in process of development, and the results cannot be estimated by chemical analysis any more than by physical processes; they can only be ascertained and compared by experiments on animals or on man.[28]

This disclaimer is retained until 1908, although both diphtheria and tetanus antitoxins are excluded from 1901, reflecting progress in standardising these two products.

Subsequent pages demonstrate a greatly expanded range for serotherapy, including ten new types of antitoxins and serums (see Table 1). Most widely used, under the heading of 'Septicaemia,' are anti-streptococcic serums and antitoxins used to treat infections and minimise the risk of blood poisoning (Table 4). A variety of preparations is available for the treatment of several forms of fever and septicaemic infection, and new indications are added in 1901. By 1904, it is noted that such infections may be due to organisms not recognised by anti-streptococcic serum. In addition, because different types of *Streptococcus* are responsible for different diseases, for example *Streptococcus pyogenes* in erysipelas, it is recommended that serums should be 'polyvalent', that is 'a mixture of several strains of the bacterium have been employed for inoculation, so as to ensure the best all-round and uniform results'.[29]

An alternative to polyvalent serum is to make serums specific for the bacterial type(s) associated with each of the various streptococcal diseases. By 1906 a range of such disease-specific serums, including one for erysipelas, is commercially available. At this time, earlier treatment, larger doses, repeated administration and localised injection are being advocated. Treatment is further extended to diseases such as acute rheumatism and arthritis. Prophylactic use is suggested from 1898 for specific cases where there is a risk of streptococcal infection and, later, prior to operations. Doses are always expressed in terms of the volume of serum rather than according to any standard. Although anti-streptococcic serum remains listed in the nineteenth edition of 1920, no significant developments are noted after 1910.

A second category that persists until 1920 is Sclavo's antitoxin to anthrax (Woolsorters' disease), although little new is noted after 1912. Another sort of antitoxin, Calmettes's 'anti-venene' to counter poisoning by snake venom after the bite of the cobra, is absent from the special chapter on antitoxins after 1910 but remains in later editions under the heading 'Serpent Venom,' puzzlingly situated in a section of 'Bacteriological Notes'.[30]

In the case of tuberculosis, it seems that good results are obtained in the treatment of some cases but, overall, anti-tuberculous serum (Marmorek's) is not successful and appears for the last time in 1915. Antitoxic serum to the plague (Yersin's Curative Serum) is still listed in

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Table 4. *Anti-streptococcic serum and antitoxin: key developments, 1898-1920*

Year	Category	Comments
1898	Producers	Introduced by Marmorek; great variety of preparations in use.
	Doses	BIPM supplies cases of three phials of 10cc liquid or equivalent dry state.
	Use	Treatment of many forms of fever due to or associated with septicaemia. Puerperal fever and septicaemia following childbirth treated with good results. Also used to treat erysipelas, scarlatina and endocarditis. Prophylaxis: recommended in cases likely to involve risk of blood poisoning.
1901	Use	Further use treating pyaemia, venereal sores and carbuncle.
1904	Products	Anti-bacterial serum should be polyvalent. Serum does not keep well and should be prepared fresh.
	Doses	A few doses of 10-20cc should be given in any septic infection.
	Use	Infection may be due to organisms not attacked by anti-streptococcic serum. In erysipelas, *Streptococcus pyogenes* is the organism responsible. Prophylaxis: suggested before operations on mouth and throat.
1906	Products	Special sera for erysipelas, puerperal fever, scarlatina, endocarditis and rheumatic fever obtainable commercially.
	Doses	30cc in any form of septicaemia repeated daily until marked improvement. In severe cases, must be given early, in 20cc doses, at least twice in 24h. 'Large doses' of serum advocated in threatened uterine infection.
	Use	Injection at seat of inflammation, e.g. in erysipelas, produces good local effect. Treatment of acute rheumatism and arthritis with some success.
1908	Use	Indicated in simple septicaemia or sapraemia.
1910	Products	'Metchnikoff's Serum' used with favourable results in erysipelas.

1915, but results are at best equivocal by 1906 and no further progress is reported afterwards. Attempts to develop a curative anti-cholera serum appear to have largely failed by 1904, although repeated attempts are recorded up to 1912. Repeated claims are made of an antitoxin treatment for typhoid fever, but these are also largely unsuccessful by 1910.

In the case of cancer, various reports claim the use of 'anti-cancer serum' made by injecting animals with erysipelas or with the 'juice' from malignant growths. In 1906 a serum (Doyen's) is made against *Micrococcus neoformans*, which is claimed to be present in portions of malignant tissue. By 1910 it is deemed that the approach is 'not to be regarded scientifically'.[31]

More speculative work on remedies for leprosy and syphilis is dropped as early as 1901. The preparations involved in these cases – the use of leper's blood to make an animal serum and the direct use of human serum from syphilitic cases – are examples of variations on the original approach of making immune serum by inoculating animals with toxins or bacilli.

There are several further additions to the serotherapy arsenal between 1901 and 1906, though notably fewer than in 1898 (see Table 1). Among those that persist are an anti-pneumococcic serum (Pane and Renzi's) and a 'bactericidal' serum against colon bacillus to treat infections in urinary organs and as a prophylactic prior to operations. By 1910, in both cases, it is accepted that the existence of bacterial variants, which may share the same microscopic appearance and culture properties, may explain why attempts at cure fail. Other noteworthy developments, which occurred in relation to serums against dysentery and cerebro-spinal fever, are considered below in the section on the First World War.

Several new categories represent further examples of anti-streptococcic serums. In the case of scarlatina, there is a new specific serum (Moser's) made by inoculating horses with the products of culture of streptococci found in the majority of fatal cases, although anti-streptococcic serum has been used in this disease since 1898 (see Table 4). The serum for scarlet fever is made through the agency of three forms of *Streptococcus*. Anti-rheumatic serum (Menzer's) is a polyvalent anti-streptococcic serum. Anti-gonococcus serum is described as being anti-streptococcic and used to treat gonorrhoeal rheumatism.

With trypanosomiasis, early attempts to use serum from horses seem not to have worked out. In 1910 suggestions are made to use instead the 'highly immune serum' of patients who have recently recovered or who have been given Atoxyl therapy (i.e. with the organoarsenic compound arsanilic acid).

The cure for inebriety proposed by Monsieur Broca of Paris, namely the injection of an 'anti-alcoholic se-

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rum' obtained from horses to which alcohol had been given is 'received with smiling incredulity' and never mentioned again![32]

Scientific developments

Beginning with the ninth edition of 1898, the authors consulted a number of specialist texts: *Immunity and Serum-Therapy* (1895) by George M. Sternberg, MD., surgeon-general with the U.S. Army; *Serum Therapy* (1903) by Richard Tanner Hewlett, MD., bacteriologist to the BIPM and later professor of general pathology and bacteriology at King's College, London; and *Serums, Vaccines and Toxines* (1904) by W. Cecil Bosanquet, MD., physician to out-patients, Victoria Hospital for Children, London.[33-35]

A renamed chapter on 'Antitoxins, Vaccines and Antitoxic Serums' in the 1901 edition is revised with the assistance of (later Sir) German Sims Woodhead (1855-1921), professor of pathology at the University of Cambridge.[12] He introduced a classification of ' "Anti" Serums' [sic], which distinguishes antitoxic serums that neutralise toxins, principally anti-diphtheritic and anti-tetanic serums, from 'anti-bacterial' serums that act directly on bacteria (the latter category including 'Cancer Anti-bacterial Serum'). In either case, the so-called ' "anti" body' [sic] is the 'immunising body'.

The chapter is substantially rewritten for the 1904 edition and includes details of 'important investigations and theories of various eminent bacteriologists' such as Paul Ehrlich (1854-1915) and his 'side-chain' theory.[36] A distinction is drawn between the soluble toxins excreted by diphtheria and tetanus bacilli and the toxins of typhoid and plague bacilli, which are inherent to the bacterial cell. In the latter case, two substances are needed: first, the immunising body in the serum after exposure to the bacillus; second, the 'complement' present in normal serum that brings about bacteriolysis. Lack of success with anti-typhoid and anti-cholera serums is postulated to be due to a deficit of complement in human blood, suggesting that adding fresh serum would be beneficial.[13]

Accordingly, the edition of 1906 includes 'Normal Horse Serum (Horse Plasma, Liquid)' to provide added complement.[14] It is also recommended as an 'ideal food' in typhoid and also useful for tuberculosis on the basis that the horse is immune to the disease. 'Byno Plasma,' a mixture of horse serum with malt extract, is a 'tissue food' to restore from collapse after parturition and for anaemia.[37] In addition 'Ox Plasma' is recommended for influenza, to which the ox is resistant.[38]

Although 'Hay Fever Serum' – obtained by injecting horses with 'irritant toxins' from grass pollen – appears in the chapter on antitoxins in 1912, it had earlier been included as 'Pollantin' in 1904 under a secondary list of drugs.[39] Thus, in fact, no novel category of serotherapy product appears in *The Extra Pharmacopoeia* from 1908 to 1920.

Vaccines and antitoxins

The edition of 1908 reflects a shift in emphasis towards vaccines:

> It is safe to say that Vaccine Therapy of late has been in the ascendency, whilst the treatment with Antitoxic Serums has fallen back in some degree; at any rate it has not progressed for any disease with the exception perhaps of diphtheria, in which the injection of Antitoxic Serum is recognised as of vital importance.[40]

Nonetheless, it is acknowledged that recent epidemics of cerebro-spinal meningitis in New York, Glasgow and Germany have 'resulted in an advance of methods of diagnosis and treatment of that disease'.[40] The dedicated chapter renamed 'Vaccines and Antitoxins' also asserts that treatment with antitoxic serums has given place to inoculation with the dead causative organisms of disease (therapeutic vaccination), treatment being dependent on the concurrent estimation of Wright's 'Opsonic Index'.[15]

Sir Almroth E. Wright (1861-1947), director of the Department for Therapeutic Inoculation, and pathologist at St. Mary's Hospital, London, had suggested that the body developed serum substances called 'opsonins', which coated microbes to make them more attractive to phagocytic white cells. He created laboratory measurements of an opsonic index (later discredited) to monitor the immune status of patients and their responses to preventive and therapeutic vaccines.[41] Increased space is devoted to describe both vaccines, including tuberculins, and opsonins.[42]

This chapter refers to a new range of therapeutic vaccines from the Wimpole Institute, a private pathology laboratory, as recommended by 'an enthusiastic worker,' Richard W. Allen (1876-1921), pathologist to the Royal Eye Hospital, London, and the author of *The Opsonic Method of Treatment* (1907).[43] Dr Allen was responsible for preparing the vaccines issued by the Wimpole Institute, and the sole agency for the sale of 'Wimpole Vaccines' in England was none other than Mr W. Martindale, chemist.[44, 45]

The Preface to the 1910 edition, responding to claims that vaccine therapy would largely replace the pharmacy of the past, seeks to reassure the pharmacist:

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> Personally we are not pessimistic as to the outlook for Pharmacy. Whatever happens, the most ardent opsonist will, we think, continue to use, e.g. narcotic, purgative and febrifuge drugs, will employ local stimulants and internal and external antiseptics to diseased tissues and so forth *ad lib*., indeed in the Vaccines themselves which he uses, the opsonist does not ignore the action of Phenol as 'preservative'.[46]

This edition provides a table of thirteen kinds of therapeutic vaccine to bacterial diseases, including cerebrospinal fever, *Coli bacillus*, *Pneumococcus*, *Streptococcus*, tuberculosis and typhoid, which are potentially competitive with antitoxins and serums; and many others, such as *Staphylococcus*, for which no serotherapy is evident.[47] By 1912, as it continued to expand, *The Extra Pharmacopoeia* required division into two volumes; volume I contains the chapter on vaccines and antitoxins with seven new vaccines listed including cholera and diphtheria.[17] In 1915, there was one addition.[18] By 1920, the total was twenty-five, including a new vaccine for dysentery.[19] Further doubts had been cast on serums in 1910:

> With the exception of antidiphtheritic and antitetanic serums, the question is asked whether the preparation of the various antibacterial serums is based on exact scientific principles.[48]

This caution is grounded in the theory that interaction between the dead micro-organisms in a vaccine and the body's tissues releases opsonins and other anti-bacterial substances into the bloodstream to incite white corpuscles to devour invading microbes:

> The Antitoxins in a *serum* probably act simply by neutralising an equivalent amount of toxin – any further action being due to the presence of dead micro-organisms in the serum, which act as a feeble vaccine.[49]

Growth in the importance of serum and vaccine therapies

The growth of serum and vaccine therapy between 1895 and 1920 can be gauged by comparing the number of pages of the chapter in *The Extra Pharmacopoeia* devoted to these preparations with the number of pages under the traditional heading of 'Materia Medica'. The number of pages devoted to antitoxins, sera and vaccines as a percentage of the pages devoted to materia medica in successive editions over this period is illustrated in Figure 1.

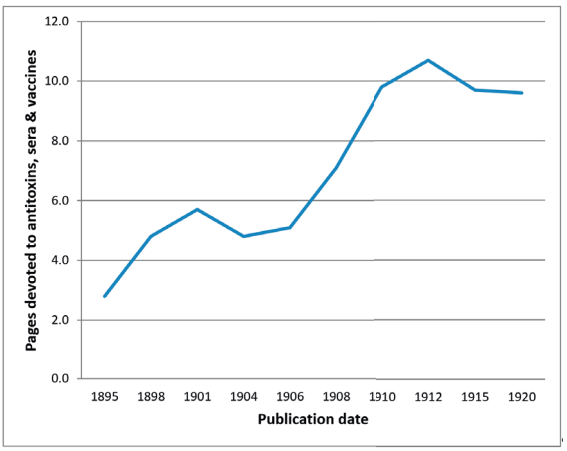

Figure 1. *The growth of serum and vaccine therapy in Britain, 1895-1920*

In the 1895 edition materia medica makes up 435 pages, or 75 per cent of 581 pages, excluding 28 introductory pages. The chapter dealing with serums and vaccines is 12 pages long, which is just less than 3 per cent of the space taken by materia medica. By 1901, the proportion had doubled to nearly 6 per cent, reflecting in part the growth of interest in serotherapy and the significant number of new serum preparations introduced over this time. Until 1906 the title of the chapter listed antitoxins ahead of vaccines.

From 1908, when the chapter title was headed by vaccines, the proportion rose higher once more, reaching a peak of more than 10 per cent in the 1912 edition,

Table 5. *Diphtheria antitoxin: key developments, 1915-1920*

Year	Category	Comments
1915	Potency	Number of immunising units per cc varies among pharmacopoeias/ manufacturers.
	Use	General opinion against use of antitoxin *per anum* and *per os.*
	Products	'Prophylactic Diphtheria Antitoxin'/'M.M.I.' (Behring): a mixture of diphtheria toxin with antitoxin in suitable proportions, acting as a prophylactic vaccine.
1920	Products	'Serum Antidiphthericum Purificatum'/'Concentrated Diphtheria Antitoxin' (*U.S.P.*) – preparation of 'antidiphtheritic globulins' purified by removing serum albumen.
	Side effects	Use of purified antitoxin may reduce untoward serum rashes.

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reflecting in part the increasing interest in therapeutic vaccines and the number of new preparations introduced over this time frame. Volume I of this edition comprised 1,114 pages (excluding 39 pages of introduction) of which 791 pages cover materia medica, representing about 70 per cent of the total, the average over the whole period. Between 1895 and 1912 the number of pages devoted to serums and vaccines increased seven-fold in absolute terms.

The First World War

Although the flow of new antitoxins and serums had effectively dried up by 1906, Martindale and Westcott did reflect the significant strides made in the use of some existing types of preparation that gained renewed importance during the First World War. Table 5 summarises developments with regard to diphtheria antitoxin during the period 1915 to 1920.

Table 6. *Tetanus antitoxin: key developments, 1915-1920*

Year	Category	Comments
1915	Products	'Tizzoni's Serum,' a special preparation in powder form.
1920	Products	'Serum Antitetanicum Purificatum'/'Concentrated Tetanus Antitoxin' (*U.S.P.*).
	Potency	Strength of antitoxin commonly determined in terms of U.S.A. units.
	Doses	Lister Institute: 'very large doses energetically and continuously' at the first sign: 3-8,000 units by lumbar puncture; 9-16,000 units iv; 10,000 units im & sc. If patient worse after 18h, repeat intraspinal dose daily for 3 or 4 days, also iv & im if required; better to give too much than too little. On improvement, give 1,500-4,000 units sc twice daily for several days. For prophylactic treatment of wounds: at least 500 units given under the skin of the abdomen or flank in every case of injury where a possibility of infection. If much soiling of the wound, or 48h has elapsed, 1,000-1,500 units and further dose of 500 units in a week. Experience gained in the first year of the war confirmed that 500-1,000 units is a sufficient prophylactic dose for most cases.
	Use	Prophylactic use is best.
	Side effects	Before iv injection, inquire if patient has any idiosyncrasy such as liability to attacks of asthma induced by sensitivity to horses.

The 1920 edition contains much new information about tetanus antitoxin (Table 6). The strength of antitetanus serum is now described in terms of U.S.A. units. For therapy, the Lister Institute advocates very large and repeated doses intraspinally, as well as by subcutaneous, intravenous and intramuscular injection. In the latter case, it is advised to ascertain if the patient has any idiosyncrasy such as asthma induced by sensitivity to horses. For the treatment of wounds, an injection of antitoxin is advised in every case where there is a possibility of infection, 'experience gained in the first year of the war' confirming that 500-1,000 units is a sufficient prophylactic dose for most cases.[50] Given the extreme measures necessary to treat a case of tetanus, stopping the disease from developing in the first place is the preferred option.

A notable development by this time is a concentrated form of tetanus antitoxin, listed in the *United States Pharmacopoeia* as 'Serum Antitetanicum Purificatum'. There is also the analogous 'Serum Antidiphthericum Purificatum'. During the purification of the antitoxic globulins present in serum, a significant quantity of irrelevant serum albumin is removed, reducing the amount of horse protein responsible for side-effects and so reducing the chance that serum sickness will occur. The edition of 1915 already warns that serum treatment 'may render the patient anaphylactic or hypersensitive to future injections of serum from that animal from which the antiserum was prepared'.[51]

An anti-dysenteric serum is available from the Lister Institute by 1906 (Table 7). Doses are quoted in terms of volume rather than according to any standard. By 1910, the serum is being raised against multiple strains of the dysentery bacillus, greater doses are recommended for serious cases, and intravenous injection advocated. Following the war, larger doses still are being advocated for the therapeutic treatment of bacillary dysentery, which was the main cause of epidemic dysentery on the Western Front, and much larger doses intravenously for the most serious cases.

Anti-meningococcus serum has been developed in response to an epidemic of cerebro-spinal fever in New York (Table 8). Doses are given in terms of volume. By 1910, large doses are employed intraspinally with some success and without untoward side-effects. The serums available at the onset of war proved of little value. How-

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Table 7. *Anti-dysentery serum: key developments, 1904-1920*

Year	Category	Comments
1904	Producers	Shiga (Japan).
	Use	Claimed to have reduced mortality of epidemic dysentery. Preliminary experiments on production of antitoxin to cure dysentery.
1906	Products	Lister Institute: serum made against the dysentery bacillus (Shiga and Kruse types) and toxic substances elaborated by the bacillus.
	Doses	From 20cc subcutaneous upwards, according to severity. For prophylaxis: 20cc subcutaneous.
	Use	Treatment lately more extensively tried; results on the whole not convincing.
	Side effects	Pains and temporary rashes may result that need not alarm.
1910	Products	Lister Institute: serum against multiple types (Shiga, Kruse, Flexner, Duval etc.).
	Doses	For a grave case, 50cc subcutaneous; in very grave, 80-100cc; for a child, half these doses; by intravenous, not more than 50cc at one time.
	Use	Stools return to normal rapidly in successful cases, but treatment to continue. In ulcerative colitis, serum which is bactericidal and antitoxic advised.
1920	Products	Serum appears to retain its toxin-neutralising power for at least 1½ years.
	Doses	In the flank: 80cc for severe, or 40-60cc for mild cases of bacillary dysentery; or, 100cc intravenous without delay followed by a second dose within 24hours; or, 60-80cc intravenous, once or twice daily, for the first 3 days. In 'fulminating' cases, much larger doses, assisted by magnesium sulphate.

Table 8. *Anti-meningococcic serum: key developments, 1906-1920*

Year	Category	Comments
1906	Products	'Anti-Meningococcus Serum' supplied in 25 and 50cc vials.
1908	Products	'Anti-Meningococcus Serum' supplied in 10 and 25cc vials.
	Doses	10cc repeated once or twice within a few days; stated to ward off relapses.
	Use	Flexner and Jobling have had good results.
1910	Products	'Flexner and Jobling's Antimeningitis Serum:' good results obtained.
	Use	Intraspinal injection under chloroform: use rigid and comparatively large trocar; drain fluid after puncture; increase flow by raising patient's head and shoulders. Intraspinal serum appears to shorten the disease and reduce mortality. Injected hypodermically, serum did not produce any marked effect.
	Doses	If very severe: 30cc or more every day for 3 days. In less urgent cases: sometimes a single injection of 30cc is valuable. Largest amount in a single case: 210cc intraspinally.
	Side effects	No undesirable symptoms follow the use of serum.
	Products	'Wassermann's Serum:' numerous recoveries. Also, a highly immune serum obtained from the blood of recovered patients.
1920	Products	Serum available at start of epidemic on Western Front found to be of little value. 1915 serum made from current epidemic strains had considerable curative potency. 'Antimeningococcic Serum New (1916)' of the Lister Institute.
	Doses	Lister serum: 30cc at earliest moment, repeated daily for at least 4 days if possible; intrathecally and intravenously successful.
	Use	Flexner serum: lumbar puncture, drainage and intrathecal injection of polyvalent anti-meningitis serum most useful treatment. In the Navy, intrathecal injections showed largest percentage recoveries.

ever, freshly prepared serums made against meningococci isolated from patients with cerebro-spinal fever in the current epidemic are effective. The subsequent identification of four meningococcal types ensures that se-

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rums have improved curative potential. The procedure involves lumbar puncture, drainage of cerebro-spinal fluid, followed by intrathecal injection of polyvalent serum, repeated as necessary.

Antibodies, the imitations of serum therapy, and combined treatments

A new sub-section of the 1912 edition headed 'Antibodies' defines the term antibody for the first time as 'a substance found in the blood serum as result of the presence in the blood of a foreign *proteid* [sic] termed its *antigen*' and emphasises that antibodies are always *specific* for their antigen. Thus, when the toxin of diphtheria acts as the antigen, it leads to the production of diphtheria antitoxin, which has no action on the toxin of tetanus, for instance.

Antibodies are classified by the effect produced on combining with their corresponding antigen: antitoxin neutralises toxin, 'precipitin' precipitates antigen, 'agglutinin' causes cell clumping, 'cytolysin' prepares cells for solution by complement, and opsonin prepares cells for ingestion by phagocytes (though not all opsonins are necessarily antibodies). This new section explains the difference between '*natural* and *acquired* immunity', and the important distinction between the '*temporary* or *passive* immunity' conferred by serum and the '*active* immunity' induced by vaccines.

The next edition of 1915 highlights some of the disadvantages of serum therapy. Because certain types of bacillus have many different types of member, antibodies efficient against one member may be altogether without effect on another member of the family. Polyvalent serums have had some success, but many failures may still be ascribed to this difficulty. Further, the immunity added by the use of a serum is limited in kind and extent. Antiserums with a high content of antitoxin contain little 'bactericidin', lysin or opsonin, hence they may neutralise the toxins circulating in the patient's body but exert little or no effect on the infective agent.

A solution to the limited and temporary immunity conferred by the transfer of antibodies is treatment in combination with vaccines. In 1910 there is a report of a polyvalent anti-streptococcic serum given to a patient while an individual vaccine is being prepared. In 1912 a vaccine against *Bacillus diphtheriae* is advocated as an adjuvant to the use of diphtheria antitoxin. The 1915 edition refers to a 'prophylactic' diphtheria antitoxin developed by Behring, which consists of a mixture of toxin and antitoxin in suitable proportions such that the toxin is neutralised yet still capable of acting as a vaccine.

A new sub-section in 1915 describes 'Sensitised Vaccines (Sero-Vaccines)', which are bacterial vaccines treated with the corresponding antiserums prior to use. The idea was that pathogenic bacteria exposed to immune serum containing numerous specific antibodies of different types would lose their virulence and become more readily phagocytosed. In certain instances, the manufacture of such vaccines employs antiserums derived from horses or calves; in other cases, human serum isolated from patients who had been highly immunised against the corresponding bacterium is used.

Sero-vaccines are perceived to have several advantages: minimal risk of overdosing, no local or general reaction, and rapid stimulation of immunity, making them ideal for use in acute, severe and emergency situations. They also have disadvantages: the degree of immunity attained is lower, their preparation risks contamination by other pathogens, and they keep less well.

In 1920 a special mention is also given to 'Gibson's Sensitised Dysentery Vaccine,' which was developed by the late Captain H. Graeme Gibson (1883-1919) of the Royal Army Medical Corps (RAMC). Since the standard approach had failed to produce an effective vaccine, Gibson reasoned that certain antibodies in anti-dysentery serum had rendered the bacteria antigenically inert. Martindale and Westcott note that

> To overcome the difficulty he absorbed these substances from the serum and after satisfying himself that the removal of the antibacterial substances from the serum did not interfere with its antitoxic action he gave the vaccine with this absorbed serum. Vaccines so treated led to very little reaction in man and laboratory tests showed that protective substances were formed in the blood.[52]

Discussion

The 1895 edition of *The Extra Pharmacopoeia* introduced a diverse range of preparations which were described using nomenclature that was potentially confusing given that the science of immunity was still at an early stage. Some were vaccines derived directly from known bacilli, or the unknown agents of disease later known as filter-passing viruses, with or without passage through animals. Others involved the use of bacterial cultures to induce immunity in a variety of species of animals to derive an antitoxic serum. In the case of diphtheria, such preparations had multiple sources, came in different forms, and varied in potency.

Diphtheria antitoxin is the remedy most closely identified with the history of serum therapy because of its success in tackling the childhood scourge of diphtheria.[53] *The Extra Pharmacopoeia* reflects how it was the

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first serotherapy to be widely developed and tested, commercialised and regulated, standardised and made official. Wide experience of its use in the lead up to the First World War allowed an understanding of how to dose and deliver antitoxins effectively for therapy, how to use them for prevention of disease and, later, how to minimise the risk of side effects. However, diphtheria antitoxin was by no means typical. Thus, from the earliest days, it was clear that tetanus antitoxin was not effective in acute cases and so its development proceeded more slowly and along different lines.

It is perhaps unsurprising that the emergence of a new approach to therapy should have been quickly and widely exploited, leading to the introduction of many novel preparations intended for the treatment of diverse infections and a number of other disorders where there was some rationale, however shaky, to attempt serotherapy. Speculative approaches, which we might today judge to be of dubious scientific or ethical quality, quickly failed to take off. Those with little or no efficacy were generally viewed with doubt and often dropped soon after.

In the case of common or difficult-to-treat diseases such as tuberculosis, pneumonia and cancer, the hopes for serum therapy lasted longer. In contrast, for epidemic diseases such as cholera, the plague and typhoid, the role for serums was less clear given the development of preventive vaccines designed to control outbreaks. For rare problems such as anthrax and poisoning by snakes, where there was no alternative remedy, serum preparations seem to have persisted despite little innovation that was deemed noteworthy.

Scientific developments noted between 1901 and 1906 identified some of the limitations of serum therapy. Many preparations, such as the various serums for septicaemia, did not appear to act by the strictly antitoxic mechanism that proved successful in the case of diphtheria. Thus, anti-bacterial serums typically had either to be polyvalent, to cover multiple strains of bacteria, or to be specific to the type of bacillus causing a particular type of infection. Even then, such serums might not kill the bacteria they recognised without added complement and they were, in any case, expected to be only partially effective in cases of mixed infection.

During this period, the concept of serotherapy was far from homogeneous and instead encompassed at least four distinct approaches: (i) antitoxic serums made by inoculating animals with toxin, poison, virus, venom, pollen or alcohol; (ii) anti-bacterial serums from animals immunised using preparations of bacteria/cell extracts; (iii) serum from animals naturally resistant to disease and thought to contain protective substances; and (iv) intravenous serum taken from patients recuperating from disease and therefore believed to have developed immunity to the infecting organism.

Enthusiasm for serotherapy had already waned by 1906 before the advent of therapeutic vaccines, which were purported to engage the phagocytic power of the white blood cells in a way that antibodies could not. As such, therapeutic inoculation could be viewed as directly competitive with serotherapy. However, after the main wave of new vaccines that lasted until about 1912, the two approaches seem to have co-existed and combined in a pragmatic and innovative fashion – vaccine as adjuvant to antitoxin, toxin-antitoxin mixture as vaccine, and novel sero-vaccines – designed to improve their therapeutic action.

Serum therapy continued to develop, however, receiving a boost in the First World War. Tetanus antitoxin had a truly antitoxic mode of action, but the characteristics of the disease made therapy a tough proposition that required aggressive treatment to have a chance of success. The problem of infection of traumatic injuries emphasised the value of prophylactic treatment of contaminated wounds with standardised antitoxin. Prevention was the preferred option even with the risk of side-effects including potentially fatal anaphylactic shock.[54]

Two other forms of serotherapy grew in importance in Britain during the war – anti-dysentery and anti-meningococcal serums – because the War Office ordered significant quantities for use by the RAMC.[55] In the case of dysentery, bacteriologists had largely worked out strain variation prior to the war so that polyvalent serum was already the norm. By contrast, the understanding of meningococcal strains was shown to be incomplete and new research was required to allow producers to develop effective polyvalent serums for the treatment of patients with cerebrospinal fever caused by the meningococcal types prevalent during the war.

An important trend that can be discerned for the principal antitoxins and serums is a move to increasingly aggressive treatment: the use of greater doses or volumes of serum, given to the patient earlier and more frequently; these doses administered intravenously or by a variety of routes, some local to or allowing better access to the seat of disease; such doses in addition to, or instead of, sub-cutaneous injection. Dose inflation may have resulted, on the one hand, when physicians gained greater confidence in using serotherapy, though, on the other, serum preparations likely lacked sufficient potency in many cases. The complexity of the antibodies later recognised to be present in anti-bacterial serums, and uncertainty regarding their precise roles in

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immunity, made it difficult to establish proper standards by comparison with antitoxins.

The path followed by any one type of antitoxin or serum will have been influenced by many factors including the nature of the disease, the scale of the medical problem, the status of scientific knowledge, the availability of other treatments, and the effectiveness of public health measures. Histories of serum therapy have tended to focus on products that address individual diseases, especially in the United States or Europe.[56-58] Alternatively, the development of the field has been considered, often on a case-by-case basis, in the wider context of vaccination or the treatment of infection.[59-61]

This article instead offers a broad perspective of the status of serum therapy and the dynamic changes that occurred in Britain in the period from 1895 to 1920 during which the understanding of infectious and other diseases was evolving, judgement of treatment efficacy was largely subjective, and outcomes were uncertain. Serum therapy was pursued because it offered a specific remedy for unmet medical needs. One hundred years later, serotherapy and its offshoots remain a valid mode of treatment: the current edition of *Martindale* lists several antitoxins, including diphtheria and tetanus, as well as several other antiserums and immunoglobulins.[62]

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ARTICLE

Arthur Rowan (1896-1971): A humanitarian during the Japanese occupation in colonial Hong Kong

Patrick Chiu

Abstract

Arthur Rowan, a pharmacist of Eurasian ancestry, embodied fearlessness and selflessness throughout an extremely challenging period during the Japanese occupation of Hong Kong between 25 December 1941 and 15 August 1945. During the three years and eight months of occupation by the Imperial Japanese Forces in this British colony, western pharmacy practice was disrupted and black market activities by unscrupulous traders were rampant. Arthur Rowan was the only pharmacist who had not fled the territory and was not held at the Japanese internment camp. Despite living in constant fear and danger, Rowan was able to smuggle medicines into the Stanley internment camps for those who needed them for life threatening conditions.

摘要 (繁體中文)

在1941年12月25日至1945年8月15日的日本佔領期間,歐亞血統的藥劑師劉仲麟(Arthur Rowan)體現了無畏和無私的態度。 在日本皇軍佔領英國殖民地的三年零八個月期間,藥劑行業被摧毀而不法商人的黑市活動猖獗。 劉仲麟是唯一沒有逃離香港殖民地的藥劑師而他也沒有被拘留在日軍的集中營。他儘管生活在不斷的恐懼和危險之中,劉仲麟堅持把藥物偷運到赤柱集中營,供應急需治療營內危重病者的藥物。

Introduction

In the first half of the twentieth century the Hong Kong colonial elite consisted of individuals ranging from colonial administrators to business and industrial leaders of British, Chinese and Eurasian ethnic groups, and they formed the backbone of the ruling class.

Arthur Rowan (his Cantonese name was Lau Chun Lun) was a Eurasian of the Anglican faith. He adopted the Chinese surname Lau based on the maiden name of his paternal grandmother. His father, Thomas Rowan, also a Eurasian, passed away when he was only ten years old, leaving Arthur and his two brothers to be raised by their mother with the help of her family.

Arthur grew up as a true gentleman of his time, embracing both British and Chinese culture, and he served the community selflessly as a humanitarian during the Japanese occupation of Hong Kong between 1941 and 1945. After eighteen days of fierce fighting, and after a loss of 1,500 troops (or 10 percent of the 15,000 strong Allied Forces led by Major-General Christopher Maltby), the Governor of Hong Kong, Mark Aitchison Young, surrendered to Lieutenant General Takashi Sakai of the Imperial Japanese Forces at the Peninsula Hotel in Kowloon on 25 December 1941 (Figure 1).

Figure 1. *Surrender of the Allied Forces in Hong Kong on 25 December, 1941 (Source: Hong Kong Public Records Office)*

Hong Kong in 1941: population, finance and economy

The population of Hong Kong dropped from 1.8 million in December 1941 to 1 million by the end of 1942, and then below 600,000 within three years and eight months under Japanese rule. [1] A target population of 500,000 was initially set by the Japanese, with a strategy of forced repatriation to deflate the population against an anticipated counter-attack by the Allied forces.

Mass exodus occurred, during which local residents and British civilians who managed to escape from the civilian internment camp in Stanley, Hong Kong Island (which was modified to accommodate 2,800 western civilian detainees) fled to anywhere in China that was free of Japanese forces. The exodus was prompted by starvation, hyper-inflation, on-going food shortages, and constant fear of execution due to non-compliance with military rules. In an article in 1996 Archer and Fedorowich explain that:

> There was one civilian camp and three prisoner-of war (POW) camps in the territory of Hong Kong. All the colonial administrators, including their family members, became internees in Stanley, on Hong Kong Island, which numbered at 2,800; an estimated 2,325 to 2,514 were British. The adult population numbered at 1,370 men and 858 women, and children 16 years of age or younger numbered at 286, 99 of whom were below the age of four. [2]

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Although medical facilities were inadequate, the internees counted amongst their number about 40 doctors, 2 dentists, 6 pharmacists, 100 trained nurses, and a large number of volunteer auxiliary nurses.[3] Because of this, according to historian G. B. Endacott, no major epidemic occurred within the Stanley internment camp.[4] The other three POW camps with over 7,000 internees were all located in Kowloon; one in Argyle Street housing military officers, one in Sham Shui Po for other ranks, and the third at Ma Tau Chung for Indians. Beri-beri (at least 600 cases were reported) and pellagra were the two common diseases in the Sham Shui Po camp due to poor food supply, resulting in malnutrition and constant ill-health.

The economy was in a shambles within six months of military occupation, with the local currency depreciating by 75 percent against the Japanese Military Yen, which severely jeopardized and interfered with daily economic activities. Factories were taken over by the Japanese for wartime production of essential commodities, forcing many factory owners and unemployed workers to flee Hong Kong. Oswald Cheung, the eldest son of a Chinese father and a Jewish mother of the Kaddorie family of Iraqi origin, recalled the harrowing days under Japanese occupation:

> In August 1942 my family ran out of money. In Hong Kong my father, who had worked for Shell since he graduated from the university, found himself out of a job. As for money in the bank, the Japanese allowed withdrawals of one quarter of deposits, and later by another 25%, leading to a rate of four dollars to one military yen.[5]

Diseases and epidemics, medical and public health, and pharmaceutical services

On 18 November 1943, *The Hong Kong News* – a daily newspaper sanctioned by the Japanese military administration – reported as follows:[6]

> The diligent and painstaking efforts of the Japanese authorities in the prevention of any outbreak of epidemics, as compared to the slovenly attitude of the former British government in Hong Kong, are clearly shown in the following table [Table 1], which is displayed in the show window of Matsusakaya.[7]

The Japanese claimed no serious epidemic occurred in Hong Kong except cholera in 1940 and 1943 (the fifteenth year of Showa[8]) with 945 and 211 affected cases respectively, and 626 and 105 fatal cases respectively. Indeed, the major causes of death were due to malnutrition, malaria, cholera, typhoid, dysentery, diphtheria, and meningitis. Sanitary control became seriously disrupted with irregular collection and disposal of refuse and night soil, failure of the supply of flushing water owing to the loss of electrical power pumps, and damage to drains and sewers from bombing and shell fire, and failure to chlorinate water. An alarming state of widespread acute infections prevailed.

Table 1. *Cases of infectious diseases reported by Japanese authorities 1940 and 1943*

Disease	Cases	1940 (fifteenth year of Showa)	1943 (eighteenth year of Showa)
Cholera	affected	945	211
Cholera	fatal	626	105
Diphtheria	affected	335	nil
Diphtheria	fatal	270	nil
Scarlet fever	affected	22	nil
Scarlet fever	fatal	nil	nil
Typhoid fever	affected	410	294
Typhoid fever	fatal	155	31
Dysentery	affected	1,343	191
Dysentery	fatal	325	56
Meningitis	affected	268	2
Meningitis	fatal	89	1

Other diseases resulting from deficiencies and supply failures included Beri Beri, tuberculosis and leprosy. Venereal diseases became widespread, and the main factors contributing to an alarming rate of infections were the closure of social hygiene clinics, interruption in the supply of anti-venereal drugs, and the rampant prostitution of local women by will or forced upon them as 'comfort women' by the invading troops.[9, 10]

A public health department was formed under the Civil Department of the Japanese Army on 1 January 1942 under Major-General Yazaki.[11] Dr P. S. Selwyn-Clarke, the director of Medical and Health Services prior to the Japanese occupation, summarized what happened in his report:

> On 1 January 1942, a Japanese Medical Department came into being (at least on paper) under Colonel T. Eguchi, but the bulk of the administrative and executive work continued to be carried out until the end of February 1942, when all European members of the department – with the exception of a small skeleton cadre – were interned following the escape

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into China of Dr Gordon King. This group consisted of two health officers, one medical officer, six sanitary inspectors, the accountant, and the writer who was appointed 'adviser'. The Asiatic elements in the department suffered a very considerable reduction, for most of the Chinese doctors, nurses, dressers, dispensers, clerks, etc. were naturally reluctant to serve in Hong Kong under Japanese control.

The report continues:

> For sixteen months the struggle to maintain such services went on, but eventually it was brought to an abrupt ending on 2 May 1943 by the arrest and the imprisonment of the writer for alleged anti-Japanese espionage and by the internment in Stanley Civilian Internment Camp of the remainder of the British and European staff three days later. From that date, the activities of the Department became progressively restricted so that when the collapse of Japanese resistance occurred in the middle of August 1945, there were very few hospitals, no welfare centres and practically no public dispensaries remaining open to the public while town cleansing and similar activities had become things of the past. On 1 September 1945 control was regained, although several days earlier the writer had contacted loyal members of the former staff to ensure that no gap occurred in the administration and that few still remaining in Hong Kong (under the writer's administrations) were ready to start on reconstruction work immediately after the Japanese were removed to concentration camps.[12]

In his account, G. B. Endacott also described the activities of clinics and hospitals that valiantly remained open during the Japanese occupation:

> There were few hospitals available to civilian population. The Japanese army took over Kowloon Hospital and the temporary hospital in the Central British School, and the British wounded were moved to St. Theresa Hospital until 1943 when this was taken for the Japanese sick. Queen Mary Hospital was used as a Japanese military hospital and then as a military barrack. The Japanese navy used the Tung Wah Eastern Hospital. Dr. Selwyn-Clarke induced the Japanese to re-open Sai Ying Poon and Tsan Yuk Hospitals but they were closed again in 1944, and the Kwong Wah Hospital and some small private hospitals were the only ones open to the Chinese community during the whole period. The old public clinics and dispensaries were closed, but eventually the Japanese began a scheme of free medicine for the poor and one hundred free beds were made available at the Kwong Wah Hospital, and by May 1945 there were thirty-eight free treatment dispensaries.[13]

The service of Dr. Selwyn-Clarke was terminated when his original sponsors – Col. T. Eguchi, aide to the Japanese Military Governor, and Mr Oda, the head of Japanese Foreign Office Staff – were transferred out of Hong Kong in the early spring of 1943, with Dr Kiribayashi appointed as the Chief of the Medical Department. He was arrested by the Kempeitai (the Japanese military police similar in function to the German Gestapo in the Second World War) and was accused of being an undercover spy for MI9,[14] (the British Directorate of Military Intelligence Section 9, a department of the War Office between 1939 and 1945) in May 1943.[15]

The clinics and hospitals under the Roman Catholic Church, which included the Sisters of the St. Paul's of Chartres, the Canossian Sisters and the Sisters of Precious Blood, amongst others, continued their services in cases of hardship, and provided free clinics for the poor throughout the period of Japanese occupation, with the exception of St. Paul's Hospital which was closed soon after an accidental bombing by the Allied Forces in April 1945.

Lewis John Morley, chief pharmacist of the colonial government, and his family were interned at the Stanley internment camp during the war. Some dispensing staff stayed on, and a few – like Ulian Khoo,[16] a dispenser who worked at the Queen Mary Hospital before the Second World War – fled to Chungking (now called Chongqing), the war-time capital of Republican China. Arthur Bentley, a pharmacist and lecturer in Hong Kong who escaped in February 1942, had an appointment at the National School of Pharmacy (NSP) in Chungking.[17]

Many western pharmacies were closed, since most expatriates including western doctors and pharmacists were either interned or departed soon after the Japanese occupation. Supplies of western drugs were mainly from Japan, and were only available on the black market at exorbitant prices. Furthermore, the practice of Traditional Chinese Medicine (TCM) was more hard hit since fresh supplies of herbal drugs from the mainland were not available.

Arthur Rowan's humble beginnings and his noble humanitarian cause

Arthur Rowan was born on 30 June 1896 in Hong Kong, being the middle child of three boys. Both of his parents were Eurasians of the Anglican faith. His father, Thomas Rowan, was also born in Hong Kong but

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died at the young age of 30. Thomas's father was a merchant captain of Scottish descent who came to Hong Kong in the latter half of the nineteenth century, and died in March 1906 at the age of 63.[18] When Thomas Rowan passed away, Arthur's mother, Cheui Saan Wen, brought the three boys back to her pre-marriage family. Arthur and his two brothers initially attended traditional Chinese classes and then completed their secondary school education at the Diocesan Boys' School, an Anglican school located in Kowloon (Figure 2).

Figure 2. *Arthur Rowan in his 20s (Source: Rowan family)*

After graduating from secondary school, Arthur taught for seven years at St. Paul's College to save enough tuition and boarding fees needed to study at Cambridge University in Britain. Arthur continued to pursue a master's degree in chemistry at the University of London, and then quickly changed his career track by passing the pharmaceutical chemist examination and became a registered pharmacist with the Pharmaceutical Society of Great Britain in July 1927. Among Arthur's two other brothers the elder, Thomas, became a lawyer and the younger, George, was a medical doctor (Figure 3).

Figure 3. *The Rowan brothers; Arthur (right), Thomas (middle), and George (left) (Source: Rowan family)*

Upon his return to Hong Kong in 1927 and after a spell of several years as a pharmacist at the Colonial Dispensary,[19] Arthur became a partner and pharmacist at the China Dispensary in the mid-1930s. During the Japanese occupation from 1942-1945 Arthur was actively involved in the smuggling of medicines into Stanley and other internment camps where British and Commonwealth citizens and their families were held as internees. Arthur was suspected of being a British spy by the Japanese military police and was arrested and beaten twice, resulting in permanent hearing loss to his left ear.

After the war, the colonial government planned to award a medal of bravery in recognition of Arthur's humanitarian acts in the supply of medicines to those interned in Stanley and other camps, but he politely declined citing Christian values and the idea that he was just acting as any responsible citizen would. At the end of the Second World War Arthur opened his own pharmacy, The Willing Dispensary, located at 30-32 Des Voeux Road Central, Hong Kong Island (Figure 4).[20]

Figure 4. *The opening ceremony of the Willing Dispensary with dragon dance in the late 1940s (Source: Rowan family)*

Arthur was better known by his Chinese name 'Lau Chun Lun' when dealing with customers and trading with local businessmen. Colleagues called him 'Lowan' (Cantonese pronunciation of the letter 'R' appears as 'L' sound), 'Lau The Chemist' or 'Lau Fa'.

Lo Man Kuen, a former government pharmacist who is now retired, had the opportunity to work during the summer months at The Willing Dispensary before he attended the pharmacy diploma course at the

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University of Hong Kong in 1952. He remembered that:

> *Lowan's Cough Mixture* was popular in the Central District but it was a secret, and no one who worked at the dispensary knew the formula. I was responsible for boiling the syrup, and another master was responsible for the addition of the active ingredients to make the cough mixture.[21]

Arthur Rowan was elected as the first president of the Hong Kong General Chamber of Pharmacy in the 1950s.[22] As a result of his efforts, the retail pharmacy segment was able to implement the Antibiotic Ordinance in a sympathetic manner during the Korean War, so that antibiotics could be sold and would be able to reach destinations where they were highly sought after for wounded soldiers with life threatening infections. He was also active in exchanges with other pharmacist groups in Southeast Asia (Figure 5).

Figure 5. *Arthur Rowan and visiting pharmacists from Singapore and Malaysia in the 1950s (Source: Rowan family)*

In the 1950 and 1960s Rowan – at the invitation of Thomas Mahon, the then chief pharmacist of the colonial government – was appointed as the proctor, charged with overseeing the biannual examinations undertaken by foreign pharmacy graduates wishing to become qualified locally. From 1961 to 1971, as an increasing number of new retail pharmacies were opened and the rental of retail premises in the Central District rose exponentially, Rowan downsized his business activities from retail pharmacy to importing and trading in medicines only. His wife Dorothy subsequently sold off the business soon after he died at the age of 75 in 1971.

Rowan's family life

Through the introduction of mutual Christian friends, Rowan, at the age of 40, married Dorothy Ying Ngan Wong in 1936, at an age considered rather late at the time (Figure 6). Dorothy graduated from the Ying Wa (literally translated as Anglo Chinese) Girls' School founded in 1900 by Helen Davies of the former London Missionary Society. Dorothy and Rowan were married for 35 years until he passed away in 1971. Dorothy passed away at the age of 94 in 2006 in California, United States.

Figure 6. *Wedding of Arthur Rowan and Dorothy Wong in 1936 (Source: Rowan family)*

Arthur and Dorothy had four daughters; they gave them names with the consecutive initials G, H, I and J, namely Geraldine, Hermione, Imogen, and Jocelyn. Arthur's wife Dorothy was a traditional wife and mother. She worked as a tutor before marriage, and became a full-time homemaker and brought up her four daughters. Geraldine graduated from Diocesan Girls' School in Jordan Road, Kowloon and the other three all followed Dorothy's footsteps and completed their studies at Ying Wa Girls' School, an Anglican school, located at the junction of Robinson Road and Bonham Road, Hong Kong Island. When Rowan passed away in Hong Kong, Dorothy joined her daughters in the United States. Before her retirement, she worked for many years at senior centres in San Diego and San Francisco.

Arthur Rowan is fondly remembered by his family. His fourth daughter, Jocelyn, recalls:

> When my father was in a good mood, he would crack jokes with us in *Pidgin* English. Over the weekends, he would take the entire family out to the Chung Chi College, the predecessor of the Chinese University of Hong Kong, in Shatin for fresh air and walk around the campus.
>
> He also liked swimming, and would practice freestyle in his trip to the floating platform and then used backstroke on his return trip. In his later years, he liked brisk walk in the mornings in a range of 2-3

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> miles as his daily exercise. Father lived on the second floor of 15 Seymour Road, Hong Kong Island before marriage and the family grew up there. Geraldine, my eldest sister, lived there until 1988 when she retired from the Department of Medical and Health before relocating to the United States. The family had lived in the same premises for half a century.

Jocelyn also remembered one of Arthur's lifelong passions.

> Father's lifelong hobby was reading mystery books. His favourite was Sir Arthur Conan Doyle's fictional detective Sherlock Holmes stories. When he studied in London in the 1920s, he even went to Baker Street and looked for number 221B. To his disappointment, 221B Baker Street was non-existent then.[23] Father could sit in his room for several hours reading novels which he borrowed from the libraries of the British and the United States Consulates. Once he finished four novels within one week, and the librarians were upset when they saw him coming back asking for more mystery books as they were not able to satisfy his appetite.[24]

Conclusion

During the three years and eight months of Japanese occupation from 1941-1945, all western pharmacies in Hong Kong were closed as British pharmacists were locked up and Chinese pharmacists fled across into the Mainland. This was the lowest point of western pharmacy since it was introduced into Hong Kong a century ago. Most traditional Chinese medicine shops were also closed since herbal medicine supply ceased due to border closures. Whilst no major epidemic arose, deaths due to starvation and other infectious diseases such as malaria were recorded. With closure of social hygiene clinics, venereal diseases – which were once controlled – once again became highly contagious as antibiotics were not available for treatment of syphilis and gonorrhea.

Arthur Rowan (aka Lau Chun Lun) was spared internment by the Japanese army who identified him more with his Chinese rather than his Eurasian heritage. He, however, risked his life and lost hearing in his left ear to save internees who desperately needed medicines for life threatening conditions. He did this for a noble humanitarian cause, truly demonstrated humility, and shunned any award for his heroic efforts. As a pharmacist, it was his selfless nature that made Arthur an exemplary role model in twentieth century Hong Kong, one who embodied many of the cornerstone virtues and values that every society would be proud of and respect.

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13. Endacott, GB. (Note 1) 1978: 145-7.
14. Section 9 of the British Directorate of Military Intelligence, known as MI9, was a department of the War Office between 1939 and 1945.
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16. Ulian Khoo, a sister of Uheng Koo, was a Malaysian Chinese who came to Hong Kong in 1938 and worked as a dispenser whilst under training as a chemist and druggist. She became the first female chief pharmacist at the Department of Medical and Health Services in Hong Kong, succeeding Thomas Mahon when he retired in June 1968.
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21. Personal interview by the author with Man-Kuen Lo, 25 April 2015.

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23. In 1990, a blue plaque signifying 221B Baker Street was installed at the Sherlock Holmes Museum in London, although the museum is actually located between 237 and 241 Baker Street.

24. Personal interview by the author with Joceylin Rowan, 8 November 2015.

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ARTICLE

Tribunal appeals against conscription by chemists and druggists in Middlesex, London during the First World War

Andrew Hersom

Abstract

In January 1916 the Military Service Act enabled the conscription of men aged between 18 and 41 years for military service. Certain industrial workers in 'certified occupations' (which included pharmacists) were, however, initially exempted. But later that year exemptions were curtailed unless that person's job was deemed essential in the national interest. Prior to obligatory conscription, discussion between the local military representative, Middlesex National Insurance Committee and Middlesex Pharmaceutical Committee had agreed which pharmacists should be exempt from conscription. This short communication reviews 51 records of appeals against conscription by other pharmacists made to military tribunals in Middlesex between 1916 and 1918.

Introduction

After two years of conflict in the First World War using volunteers, the authorities found it necessary to introduce conscription, since the numbers volunteering were inadequate for the needs of the military. In January 1916 the government persuaded Parliament to pass the Military Service Bill which, once enacted, enabled conscription of single men aged between 18 and 41 years. Single young men were to be called up in age order, but the Act exempted the medically unfit, clergymen, teachers and certain classes of industrial workers in 'certified occupations'. In addition, conscientious objectors – men who objected to fighting on moral grounds – were also to be exempted if a tribunal found them to be sincere in their beliefs.

A second Act passed in May 1916 extended conscription to married men who – like single men – were then called up in age order. During the last months of the war in 1918, the age limit was raised to 51 years. Also, early in 1918, any previous exemptions were cancelled.

Initially, amongst those in the long list of certified occupations exempt from conscription were chemists, that is, anyone who was a 'chemist in the sense of a person dispensing medicines under the National Insurance Acts. [1] However, in May 1916 the list of Certified Occupations was amended to:

> Men lawfully and habitually engaged in dispensing medicines, to be exempted if agreed to be indispensable for the needs of the population by the Military Representative, after consultation with the Insurance Committee for the area, or if recommended by the National Health Insurance Commission and approved by the Army Council.[2]

This meant that some chemists and druggists were liable to be called up to fight, unless they could justify otherwise.

Grounds for appealing against conscription

If a man felt he should be exempt from military service, he could apply to his local tribunal based at the Urban District Council level. If he disagreed with the local tribunal's decision that he would have to join the armed forces, he could make an appeal to County Appeals Tribunal. With permission, he could make a final appeal to a Central Appeals Tribunal. When it came to making an appeal, applicants could apply for an absolute, conditional or temporary exemption, under one or more of the seven 'grounds for appeal'. The legislation (Military Service Act 1916, chapter 104) stated these as follows:

1. On the ground that it is expedient in the national interests that the man should, instead of being employed in military service, be engaged in other work in which he is habitually engaged;
2. On the ground that it is expedient in the national interests that the man should, instead of being employed in military service, be engaged in other work which he wishes to be engaged;
3. If he is being educated or trained for any work, on the ground that it is expedient in the national interests that, instead of being employed in military service, he should continue to be so educated or trained;
4. On the ground that serious hardship would ensure if the man were called up for Army service, owing to his exceptional financial or business obligations or domestic position;
5. On the ground of ill-health or infirmity;
6. On the ground of a conscientious objection to the undertaking of combatant service;
7. On the ground that the principal and usual occupation of the man is one of those included in the list of occupations certified by Government Departments for exemption.

In theory, there were a great many grounds for exemption, but the government made it clear early on that these only applied if the exemption was 'in the national interest'.

In this short communication the records relating to 'chemists' or 'pharmacists' resident within the county

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of Middlesex in London were accessed online from the website of The National Archives at Kew, London.[3] Records relating to non-pharmaceutical or analytical chemists were excluded. A total of 51 cases were identified, of which 25 were identified as chemists and druggists or pharmaceutical chemists in the 1919 *Registers of Pharmaceutical Chemists and Chemist and Druggists* kept by the Pharmaceutical Society of Great Britain.[4] Three individuals self-identified as being pharmaceutically qualified, but their names do not appear in the 1919 register. The remainder were identified as non-pharmaceutically qualified chemist's assistants or dispensers. One appellant dispensed at Middlesex Red Cross Hospital. There were no other hospital pharmacists, and incidentally, no doctors, physicians or surgeons listed in the appeals.

The appeals procedure

Individuals receiving call-up papers could either agree and accept, or they could claim exemption under one of the stated categories. Decisions about exemptions were initially taken at the Urban District Council level. Subsequent appeals were submitted to the County Military Appeal Tribunal (the subject of this communication). The Military Appeal Tribunal for Middlesex was announced in the *London Gazette* on 25 February 1916.[5] It consisted of 10 members, most of whom were magistrates (Justices of the Peace, JP) and members of the Middlesex County Council (MCC). Some were, or would later become, chairmen of Middlesex County Council (Table 1).

Others were later co-opted onto the tribunal. For example, Charles A. Buckmaster, who was an Assistant Secretary on the Middlesex Education Board, also served. Several members had a personal investment in the war; Cecil Fane De Salis had four sons serving in the army, two of whom were killed in action. Herbert Nield lost one of his two sons.

In addition to the County level tribunal, local district tribunals were constituted. Members of the Military Appeal Tribunal for Middlesex also served on some of these. The County Appeals Tribunals had very little flexibility, and many appeals were summarily rejected; most exemptions were conditional or temporary.

The County Appeal Military Representative was (temporary) Captain Rudolph Edward Victor Bax, of the Middlesex Regiment Territorial Force.[6] Bax was a barrister-in-law before the war. There were also other military representatives. When it came to considering claims for exemption from 'men lawfully and habitually engaged in dispensing medicines', exemption on the grounds of being 'indispensable for the needs of the population' was to be agreed by the Military Representative only after consultation with the Insurance Committee for the area.

The Middlesex National Insurance Committee[7] was chaired by William (later Sir William) Glyn-Jones. Glyn-Jones initially qualified as a pharmacist, and later was the Parliamentary Secretary for the Pharmaceutical Society of Great Britain. He had been instrumental in setting up the Proprietary Articles Trade Association (PATA) in 1896 to press for the resale price maintenance of medicines, and was the key figure in persuading the government that pharmacists must be involved in dispensing prescriptions under the 1911 National Insurance Act.[8] By the start of the war he was a Justice of the Peace, a Member of Parliament, a barrister and an Alderman of Middlesex County Council.

In turn, the Middlesex National Insurance Committee took advice about pharmaceutical services from the Middlesex Pharmaceutical Committee, chaired by

Table 1. *Members of the Middlesex Military Appeal Tribunal 1916-18*

Name	Status	Role on MCC	Other roles
Viscount Enfield	Landowner	Alderman	Alderman, Hertfordshire
Henry Burt	JP	Member	Member of Hornsey Council
Cecil Fane de Salis	JP	Member	Landowner
James Devonshire	Businessman		Electrical engineer and managing director of London United Tramways Ltd and London and Suburban Electric Traction Co. Ltd.
John Dobson	JP		Member of Tottenham Urban District Council
Philip Hewlett	Trade Unionist		Great Western Railway Signalman
William Luke	JP		
Herbert Nield	JP		King's Counsel, Member of Parliament and Deputy Lieutenant for the County of Middlesex
William Regester	JP	Chairman	
Montagu Sharpe	JP	Member	Lawyer

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Herbert Skinner. Skinner qualified as a pharmaceutical chemist in 1891 and lived in Highgate, north London. He was a member of the Council of the Pharmaceutical Society of Great Britain, and became its president in 1927.[8]

The secretary of the Middlesex Pharmaceutical Committee was Hugo Wolff, who qualified as a chemist and druggist in 1901. Wolff is listed in the 1914 edition of *Kelly's Directory* [9] as having a shop in South Tottenham; but he was also an assistant to Alec Nathan, of Joseph Nathan & Co. Ltd, the company that later became Glaxo.[10] He was also involved with the PATA and resale price maintenance. After the war he became sales director at Glaxo.

Appeals by chemists and druggists

It is clear from the records that some members of the Middlesex Insurance Committee, together with some members of the Middlesex Pharmaceutical Committee, met Captain Bax, the Military Representative, to agree which pharmacists aged under 41 years could be exempted from conscription to ensure that patients could continue to receive their medicines.

According to the 1914 *Kelly's Directory,* there were 279 chemist and druggist premises in Middlesex. This number is approximate as some businesses may not appear in *Kelly's Directory.* It is presumed that those pharmacists providing services deemed essential had been identified, and those appealing were those who disagreed with this assessment. This suggests that approximately 255 pharmacies (279 less 24) were deemed essential by the Middlesex Insurance Committee (and presumably the Middlesex Pharmaceutical Committee), and that this figure was agreed by the Military Representative.

The population of Middlesex in 1914 was approximately 500,000, which indicates a ratio of around 2,000 patients per pharmacy. The records involving individual appeals to military tribunals (with the exception of Middlesex and Peebles and Lothian in Scotland) were supposed to be destroyed after the First World War on Government instructions due to the sensitivity of the cases, the Middlesex and Peebles and Lothian records being retained as examples.

Results of the appeals

During the 35 months between January 1916 and November 1918, a total of 51 appeals were heard by the Military Appeal Tribunal for Middlesex. These are summarised in Table 2.

Table 2. *Summary of Appeals heard by the Military Appeal Tribunal for Middlesex 1916-1918*

Name	Board reference	Date first appeal	Age	Job title	PSGB register	Tribunal result
F H Quadling	M3	15.2.1916	26	Pharmaceutical Chemist	1911	Temporary exemption
G Lightfoot	M16	24.2.1916	19	Chemist's Dispenser	-	Appeal dismissed
F C Williams	M44	16.2.1916	22	Chemist & Druggist. MPS	1915	Appeal dismissed
V C Ellis	M53	17.2.1916	21	Chemist dispensing under the NI Act	(1)	Appeal dismissed
J J Laws	M701	28.2.1916	20	Student for pharmaceutical/ medical exams	-	Temporary exemption
H G Brooke	M1036	20.6.1916	24	Chemist's Dispenser	-	Appeal dismissed
H Blake	M1165	5.6.1916	27	Pharmacist	1913	Appeal dismissed
W A Elliff	M2326 E	15.9.1916	29	Pharmacist	1914	Appeal dismissed
E H Marshall	M3369	20.6.1916	20	Assistant to Father (Chemist)	-	Withdrew appeal
B Hickox	M4579	30.9.1916	21	Chemist's Assistant	-	Temporary exemption
W Jarvis	M4718	19.6.1916	33	Qualified Chemist employed as Manager	1905	Referred to Oxford
R H Marchment	M4824	25.5.1917	34	Analytical Chemist managing pharmacy	-	Temporary exemption
R O Bird	M4568	16.6.1916	30	Chemist + Dentist (Unqualified)	(1)	Temporary exemption
H W Hall	M1458	10.6.1916	32	Chemist's Dispenser	-	Temporary exemption

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Table 2. *(cont.)*

J Todd	M3147	16.6.1916	37	Qualified Chemists Manager & Dispenser	1902	Temporary exemption
T G Matson	M4403	5.9.1917	29	Chemist's Associate	-	Temporary exemption
J R Waddell	M5103	15.9.1917	34	Chemist (Dispensing)	(2)	Conditional exemption
J A Cardno	M5170	26.5.1917	37	Qualified Chemist & Druggist	1902	Conditional exemption
G Field	M5641	29.6.1918	45	Chemist's Assistant	-	Temporary exemption
C Scott	M5711	7.6.1918	46	Dispensing Chemist	(1)	Temporary exemption
B W Brims	M5195	12.6.1916	31	Chemist & Druggist	1907	Conditional exemption
K E Jordan	M5328	7.1.1918	33	Pharmacist	1916	Temporary exemption
D O Williams	V183	19.2.1916	31	Chemist's Assistant + Dispenser	-	Appeal dismissed
J L Mullin	V594	21.3.1916	25	Chemist's Dispenser	-	Appeal dismissed
J Kossick	V762	31.3.1916	32	Chemist's Assistant	-	Appeal dismissed
W A Fryer	V1110	5.6.1916	25	Qualified Pharmacist	1916	Temporary exemption
C B Snow	V1269	18.3.1916	26	Pharmacy Owner	-	Appeal dismissed
R B Congdon	V1298	6.6.1916	33	Dispenser & Chemist's Assistant	-	Temporary exemption
F W Broadbridge	V1672	16.6.1916	25	Chemist's Assistant	-	Temporary exemption
C F Humphreys	V2406	27.10.1916	-	Chemist's Assistant	-	Referred back
H J Heath	V2570	5.5.1916	34	Stock keeper + Chemist's Assistant	-	Appeal dismissed
W J E Gould	V2648	23.11.1916	23	Chemist (Assistant)	1915	Withdrew appeal
F E Goodfellow	V2730	6.1.1916	24	Chemist	1915	Withdrew appeal
E Aspden	V3156	27.12.1916	37	Chemist	1901	Appeal dismissed
A E K Moon	V3333	7.2.1916	38	Chemist's Assistant	-	Temporary exemption
CA Macdonald	V3475	24.3.1917	36	Chemist & Druggist	1903	Exemption sustained
D S Henderson	V3526	6.3.1917	24	Qualified Chemist	1915	Appeal dismissed
S W Harrison	V3696	14.4.1917	35	Chemist + Optician	1906	Appeal dismissed
A A Martret	V3768	13.1.1916	27	Qualified Chemist, reg'd pharmacist	1915	Appeal dismissed
A Edmondson	V4090	19.6.1917	24	Chemist's Assistant	-	Appeal dismissed
J B Hewitt	V4904	3.5.1918	30	Dispensing Chemist & Pharmacist	1907	Appeal dismissed
W J H Clarke	V5143	4.7.1918	33	Dispensing Chemist	1907	Appeal dismissed
J F Furnivall	V2823	1.11.1916	41	Chemist & Druggist, Dentist	1901	Conditional exemption
J L Morrison	V5015	17.2.1916	41	Chemist & Druggist, Ophthalmic Optician	1898	Conditional exemption

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Table 2. *(cont.)*

A Heath	V4843	15.5.1916	35	Dispensing Chemist	1909	Conditional Exemption
J W Butterworth	V4877	3.5.1918	23	Pharmacist & Optician	1913	Appeal dismissed
B Hickox	RM1/263	18.5.1918	22	Chemist's Assistant +Dispenser	-	Unknown
S C Hudson	RM1/1315	2.8.1918	38	Dispensing & Photographic Chemist	1901	Unknown
F J Mills	RM1/1463	20.9.1918	26	Dispensing Chemist Assistant	-	Unknown
W Bridges	RM1/1485	30.9.1918	32	Managing Chemist qualified	1910	Unknown
M Phillips	RM 1/1460	18.9.1918	26	Chemist's Assistant	-	Unknown

Notes: (1) Not listed as a pharmaceutical chemist or chemist and druggist in the *Registers of Pharmaceutical Chemists and Chemist and Druggists 1919*. (2) Licentiate of the Pharmaceutical Society of Ireland (equivalent to a chemist's assistant) registered 26 January 1909, number 986.

Appellant's ages at the time of appeal varied between 19 and 46 years of age. Their grounds for appealing against conscription also varied considerably. Tribunal decisions were: appeal dismissed 19, appeal withdrawn 3, conditional exemption 6, exemption sustained 1, referred back to original tribunal 2, temporary exemption 15 and unknown 5. These are illustrated in a series of case studies.

Case 1: Dependent relatives

The first case was that of Frederick Quadling of Uxbridge, who claimed he had tried to volunteer in August 1914 but had been rejected on medical grounds, so he had bought a shop and thereby acquired significant debt. His mother was solely dependent on him. He dispensed 170 National Health Insurance prescriptions a month. He was given a 3 month temporary exemption, as the Military Representative stated that the exemption rules would soon be changing.

Quadling appealed the finding to the central Middlesex tribunal via his solicitor, but withdrew his application as it was pointed out that he would get five months exemption altogether.

Unfortunately there is no further information. Quadling's name does not appear on the list of enlisted soldiers on the forces-records.co.uk website, but he is recorded in the 1919 *Registers of Pharmaceutical Chemists and Chemist and Druggists*.[4]

Case 2: Indispensable to the business

Frederick Charles Williams was employed at Ernest Drayton in Ealing. In the dossier is a letter from the secretary of the Middlesex Pharmaceutical Committee, Hugo Wolff MPS, confirming that the committee was working with Middlesex Insurance Committee and the National Health Insurance Commissioners to ascertain what men can be spared for military service. The Military Representative stated that there were two fully qualified pharmacists in this small business, and in his opinion he did not consider this necessary. Also, they did far more dispensing for private customers than panel work under the National Health Insurance Act.

The Ealing tribunal chairman's reason for the decision was that Williams admitted during questioning that his National Health Insurance dispensing was insignificant, and that this was not his principal and usual occupation. His appeal was dismissed a month later at the Middlesex tribunal.

Williams is not listed in the 1919 *Registers of Pharmaceutical Chemists and Chemist and Druggists*, so it must be assumed that he did not survive military service (there were nine soldiers with this name who died in the war).

Case 3: Conscientious objector

Harrold Blake appealed to the Ruislip Northwood Tribunal on the basis of conscientious objection. He was employed at H.B. Sharman Chemists of Northwood. Despite writing a statement of his beliefs and two references, the application was refused, with the recommendation that he serve in a non-combatant role as a dispenser in the RAMC. He appealed to the Middlesex Tribunal and this was dismissed. Leave to appeal to the Central Appeals Tribunal was refused. He was called up, refused to serve, was court martialled and imprisoned in Wormwood Scrubs, but he survived and returned to civilian life, eventually dying in 1980.[11] Harrold Blake is listed in the 1919 *Registers of Pharmaceutical Chemists and Chemist and Druggists*.

Case 4: Sudden death of employer

William Arthur Elliff was employed by Alexander Mackay Chemists in Hendon. He had already volunteered as a dispenser in the RAMC when Mackay suddenly

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died. As it was impossible to find a replacement immediately he therefore requested a temporary exemption for a few days to allow this. This was refused. It has not been possible to find a record of Elliff in the war forces website, but he does appear in 1919 *Registers of Pharmaceutical Chemists and Chemist and Druggists*.

Case 5: Suffered nervous breakdown

William Jarvis was employed by W. Armitage of Ealing, and he appealed to the Ealing Tribunal on the basis of his mental health (nervous breakdown). He was given six months' temporary exemption. He subsequently moved around the country, and his exemption was stopped on the basis that he had stopped working as a pharmacist (due to his health). It is not clear what happened next, but he is listed in the 1919 *Registers of Pharmaceutical Chemists and Chemist and Druggists*.[4]

Case 6: The pharmacy owner

Reginald Owen Bird of John Davies Chemists, Willesden gave his occupation as chemists' manager and proprietor and described himself as a chemist and dentist (unqualified). He claimed exemption on the basis he had been discharged from the army in 1915 and thereafter opened three 'drug stores'. One had to be closed due to his inability to get someone to work there; he ran the other two shops with an elderly man who suffered from long-term illness.

Bird challenged his medical classification of B1 as he had congenital syphilis; this was later re-assessed at C1. The claim that he was involved in National Health Insurance dispensing was challenged on the basis that he was not pharmaceutically qualified. Also, someone from the tribunal visited his two shops on two occasions – each time the claimant was absent. Nevertheless he was given six weeks' exemption on medical grounds and to have time to sort out his affairs; the exemption was extended first by four months and then for a further six months. Bird was later imprisoned for six months at the Old Bailey for obtaining raw materials improperly by fraud.

Case 7: Heavy workload

Arthur Edmondson was employed as a dispenser at J.T. Davy Chemists of Fore Street, Edmonton. The claim was made by his employer, who appealed on the basis that dispensing 19,700 prescription items a year made him essential to the continuation of the panel contract (i.e. National Health Insurance dispensing) by the business. Hugo Wolff, Middlesex Pharmaceutical Committee was present but did not appear to otherwise support the appeal, which allowed a temporary exemption of just a fortnight. It is possible that the view was that there were two other chemists in Fore Street, Edmonton and that these could cope with the workload.

Conclusion

During the First World War, chemists and druggists were initially eligible for exemption from conscription, but almost immediately the government changed the rules, such that they would only be eligible for exemption if this was agreed by the local Military Representative and the insurance committee to be in the 'national interest'.

Appeals presumably came from those excluded from these agreements, so were not representative of the profession as a whole. It has not been possible to locate any surviving records from either the Middlesex Insurance Committee or the Middlesex Pharmaceutical Committee, and some of the tribunal records are incomplete.

Individual dossiers make it clear that the Middlesex Pharmaceutical Committee had met both the Middlesex Insurance Committee and the local Military Representative prior to an appeal, to agree which chemists were essential to sustain adequate pharmaceutical services for the local population. Some high streets almost certainly had an excess of chemists. The Military Tribunals had a very difficult job, and they did their best according to the rules provided by the Government.[12] But, regardless of the reason given for claiming exemption, the majority of claims and appeals by chemists were rejected, or else the exemptions given were either conditional or temporary.

Acknowledgments

I should like to thank Stuart Anderson for advice during researching of this article and Margaret Hersom for comments whilst writing up the results.

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SHORT COMMUNICATION

A vegetable drugs historian: Daniel Hanbury, 1825-1875

Harkishan Singh

Abstract

Daniel Hanbury belonged to a Quaker family intricately bound up with pharmacy. He qualified as a pharmaceutical chemist in 1857. He remained in business at Plough Court until 1870. He developed an interest in botanical and crude drugs. Most of his publications were concerned with crude drugs in common use. *Pharmacographia* was his major work, for the preparation of which he collaborated with Professor Friedrich A. Flückiger at the University of Strasburg. *Pharmacographia* is a history of the principal drugs of vegetable origin met with in Great Britain and British India. It was first published in 1874, and was followed by a second edition in 1879. Daniel Hanbury was a contributor to the *Pharmaceutical Journal* and to the *Journal of the Linnean Society*. He was elected a Fellow of the Royal Society in 1867.

Early life and studies

The major sources for biographic material on Daniel Hanbury which became available to me are the accounts by Wallis,[1] Shellard,[2] and Ince.[3] Daniel Hanbury was born on 11 September 1825 and was the elder son of Daniel Bell Hanbury and his wife Rachel.[1] He belonged to a Quaker family intricately bound up with pharmacy. Daniel attended a local school in Clapham, south London. On leaving the school he was apprenticed to the family business at Plough Court, London and then started attending lectures at the school of pharmacy, recently established by the Pharmaceutical Society. He qualified as a pharmaceutical chemist in 1857. He remained in business at Plough Court until 1870.

Daniel's interest in botanical and crude drugs had been initiated by the lectures of Professor Todd Thompson on botany and Professor Pereira on materia medica.[2] An impressive account of his publications has been provided. Altogether he published 81 papers and by far the largest proportion of them were concerned with the crude drugs then in common use. In order to obtain first-hand information about the drugs and the plants which yielded them, Hanbury wrote to botanists, pharmacists, travellers and indeed anyone – including High Commissioners – who he thought could supply information and materials. He wrote many hundreds of letters and received many hundreds of letters in return from people living in many different countries around the world. He frequently sent money to encourage collectors to obtain flowering specimens of plants.

What follows is a selective coverage of the works and other information pertaining to the involvement of Daniel Hanbury with vegetable drugs that have become available.

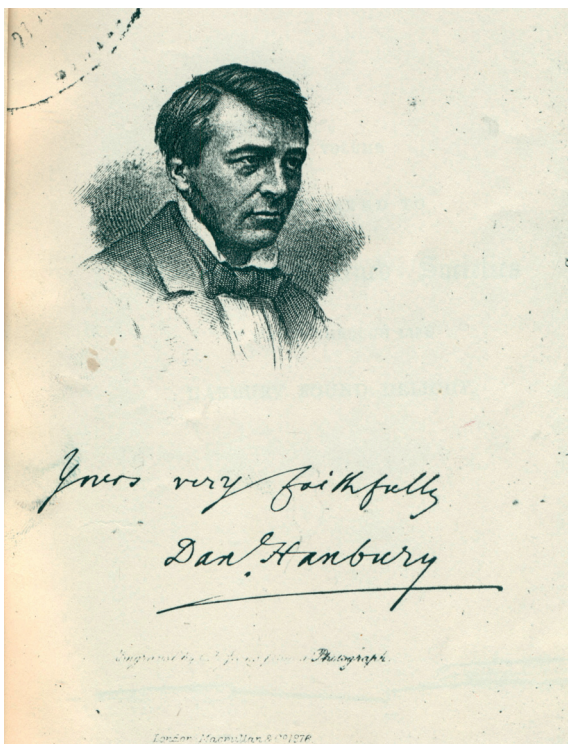

Figure 1. *Portrait of Daniel Hanbury (Source: Science Papers, Joseph Ince (Note 3) 1876)*

Pharmacographia

Pharmacographia is a monumental work, in the preparation of which Daniel Hanbury collaborated with Professor Friedrich A. Flückiger at the University of Strasburg. The publication records the history of the principal drugs of vegetable origin met with in Great Britain and British India.[4]

Before going further a brief introduction to the life and career of Flückiger is helpful. Friedrich August Flückiger (15 May 1828-11 December 1894) was professor of pharmacy and director of the Pharmaceutical Institute of the University of Strasburg.[5] He studied chemistry and geology at Berlin University. From 1847 to 1850 Flückiger was engaged as an apprentice in a pharmacy at Solothurn in Switzerland. He took his Apothekar degree at Strasburg, and in 1851 he moved to Heidelburg to continue his studies. From 1858 to

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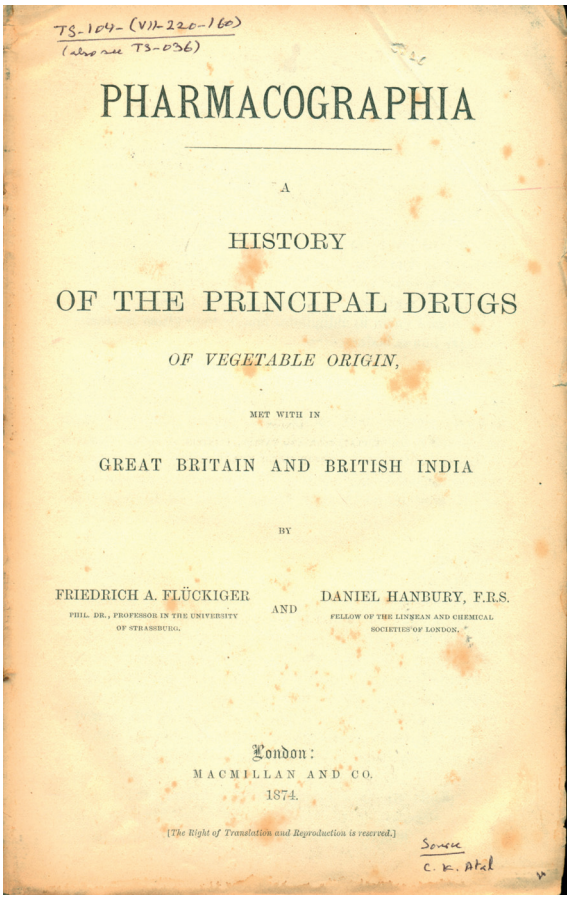
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(also see TS-036)

PHARMACOGRAPHIA

A

HISTORY

OF THE PRINCIPAL DRUGS

OF VEGETABLE ORIGIN,

MET WITH IN

GREAT BRITAIN AND BRITISH INDIA

BY

FRIEDRICH A. FLÜCKIGER
PHIL. DR., PROFESSOR IN THE UNIVERSITY OF STRASSBURG.

AND

DANIEL HANBURY, F.R.S.
FELLOW OF THE LINNEAN AND CHEMICAL SOCIETIES OF LONDON.

London:
MACMILLAN AND CO.
1874.

[The Right of Translation and Reproduction is reserved.]

Source
C. K. Atal

Figure 2. *Title page of Pharmacographia: A History of the Principal Drugs of Vegetable Origin met with in Great Britain and British India, 1874 (Source: Regional Research Laboratory, Jammu)*

1866 he acted as President of the Swiss Pharmaceutical Society. In 1870 he was appointed professor extraordinary at the University of Berne. In 1873 Flückiger accepted the appointment of professor of pharmacy at the

Figure 3. *Friedrich August Flückiger 1828-1894 (Source: Chemist and Druggist 1894; 45: 880)*

Kaiser Wilhelm University of Strasburg. He held this chair for 20 years, in the course of which his name became known and esteemed in pharmaceutical circles throughout the world.

In my archival collection the original *Pharmacographia* is available. It came to me from Dr C. K. Atal who at the time was director (1971-1984) of the Regional Research Laboratory at Jammu. In the preface it is stated:

> The drugs included in the present work are chiefly those which are commonly kept in stores by pharmacists, or are known in the drug and spice market in London. The work likewise contains a comparatively small number which belong to the *Pharmacopoeia of India*…Supplementary to these two groups must be placed a very few substances which possess little more than historical interest.

The volume runs to xviii + 704 pages. The major bulk of the book is occupied by a section entitled 'Phaenogamous or Flowering Plants', largely covering 'Dicotyledons' (pages 1-568) placed under their respective families; mostly the plants belong to the *Ranuculaceae, Leguminosae, Rosaceae, Umbelliferae, Compositae, Solanaceae, Labiatae, Euphorbiaceae, Piperaceae,* and *Coniferae* families.

Among 'Monocotyledons' (pages 569-664), plants are largely from the *Zingiberacae, Melanthaceae* and *Graminae* families. Next are the 'Cryptogamous or Flowerless Plants' (pages 665-682), including 'Acrogens' and 'Thallogens'. Placed next is the 'Index' (pages 685-704).

Each drug is headed by the Latin name, followed by such few synonyms as may suffice for perfect identification, together in most cases with English, French and German designations. Then follow the information regarding the 'Botanical Origin', 'History', 'Description', 'Microscopic Structure', 'Chemical Composition', 'Uses' and 'Substitutes'.

A copy of the second edition of *Pharmacographia,* which was published in 1879, became available to me at the Connemara Public Library in Madras (now Chennai).[6] I was allowed to get some selected pages photocopied. The second edition continued to be a joint publication. However Professor FA Flückiger noted in the fresh preface:

> Premature death – March 24, 1875 – of my lamented friend Daniel Hanbury, having deprived me of his invaluable assistance, I have attempted to prepare the new edition of our work with adherence to the same principles by which we were guided from the beginning.

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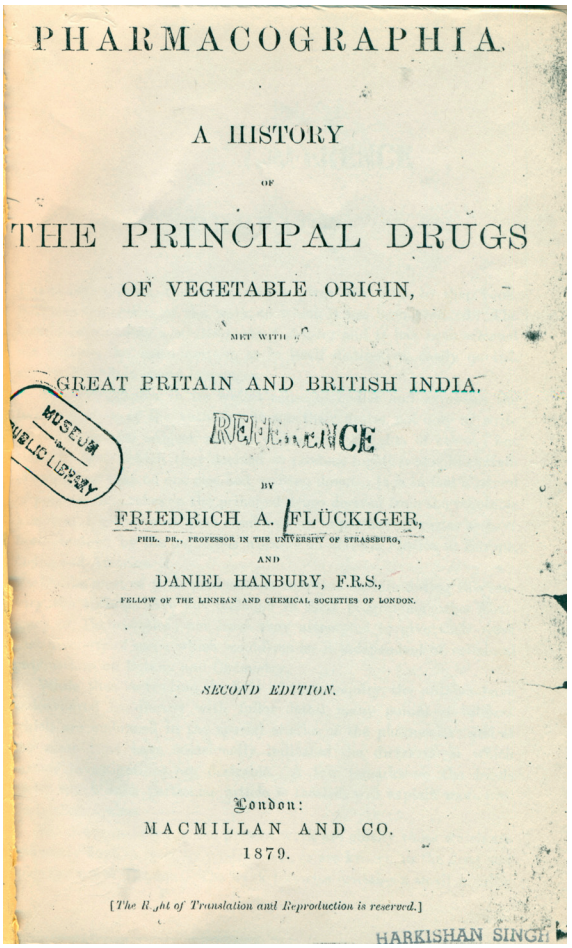

PHARMACOGRAPHIA.

A HISTORY

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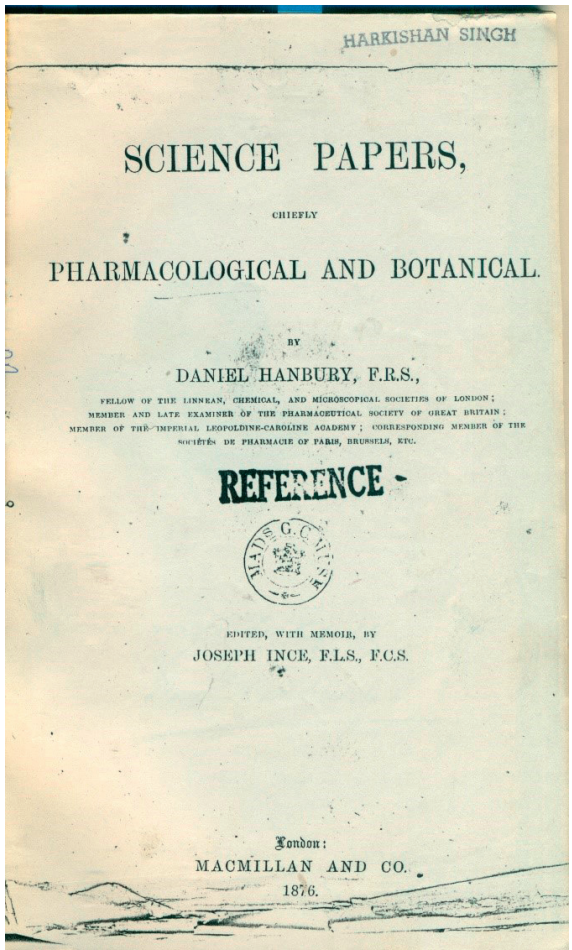
FELLOW OF THE LINNEAN AND CHEMICAL SOCIETIES OF LONDON.

SECOND EDITION.

London:
MACMILLAN AND CO.
1879.

Figure 4. *Title page of the Pharmacographia: A History of the Principal Drugs of Vegetable Origin met with in Great Britain and British India; Second Edition, 1879 (Source: Connemara Public Library, Chennai)*



SCIENCE PAPERS,

CHIEFLY

PHARMACOLOGICAL AND BOTANICAL.

BY

DANIEL HANBURY, F.R.S.,

FELLOW OF THE LINNEAN, CHEMICAL, AND MICROSCOPICAL SOCIETIES OF LONDON;
MEMBER AND LATE EXAMINER OF THE PHARMACEUTICAL SOCIETY OF GREAT BRITAIN;
MEMBER OF THE IMPERIAL LEOPOLDINE-CAROLINE ACADEMY; CORRESPONDING MEMBER OF THE SOCIÉTÉS DE PHARMACIE OF PARIS, BRUSSELS, ETC.

EDITED, WITH MEMOIR, BY

JOSEPH INCE, F.L.S., F.C.S.

London:
MACMILLAN AND CO.
1876.

Figure 5. *Title page of Science Papers, Chiefly Pharmacological and Botanical (Source: Connemara Public Library, Chennai)*

In the second edition, there was a marginal increase in the bulk, as is apparent from the contents pages. In the new addition before the 'Index' was the 'Appendix' which covered 'Short Biographic and Bibliographic Notes' relating to authors and books quoted in the *Pharmacographia*.

Science papers

At the Connemara Public Library there also became available to me a copy of the publication *Science Papers, Chiefly Pharmacological and Botanical*.[7] I could get photocopies of a limited number of pages. The 'Contents', in addition to the 'Memoir' (pages 3-40) list the 'Science Papers' (page 43 and onwards), 'Addresses and Miscellaneous Papers' (page 403 and onwards), and 'Appendix' (page 487 and onwards). Out of these I have only with me a photocopy of the 'Memoir'. Out of the 60 illustrations, I only have a copy of the portrait of Daniel Hanbury.

Epilogue

Some extracts which appeared in the obituary of Daniel Hanbury in the Proceedings of the Chemical Society may be taken note of.[8] Whilst alluding to his writings we must not omit to mention the important part he played in the preparation of the *Pharmacopoeia of India,* a work involving much labour. He was also one of those deputed to draw up the *Admiralty Manual of Scientific Inquiry*. But botany was the science to which he especially devoted his attention. He contributed to the *Transactions of the Linnean Society,* and numerous papers by him are to be found in the *Journal of the Linnean Society*.

Hanbury served on the juries of the International Exhibitions in 1862 and in 1867, and in an earlier year acted as Secretary to the Jury on Vegetable Products, the proceedings of which were conducted in French. Daniel Hanbury was elected as a Fellow of the Chemical Society in 1857, and as a member of its Council in

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1869. In 1867, on his first nomination, he was elected as a Fellow of the Royal Society, and as a Member of its Council in 1869. He was a warm supporter of the Pharmaceutical Society of Great Britain, almost from its origin. He published extensively in the *Pharmaceutical Journal;* his series of papers on Chinese materia medica were highly regarded.

Daniel Hanbury never married, but lived with his parents, to whom he was a most kind and affectionate son. Though possessed with ample means, his habits, both from principle and taste, were remarkably simple and inexpensive. He was always an early riser. In his biography of Hanbury, Shellard noted:

> Daniel Hanbury lived for less than 50 years, with only 25 years of active scientific life, but he is considered to have been the most outstanding British pharmacognosist of all, since his work gave to pharmacy the status which it badly needed.[2]

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